ELECTRONICS Australia

HIFI NEWS

DECEMBER, 1976 AUST $1.00* NZ $1.20

NEW AWA SPEAKER GIVES MORE BASS

NEW "HAM" RECEIVER, SIMPLE DIGITAL CLOCK

SC/MP GETS TINY BASIC!

AUSTRALIAN-MADE TELEPRINTER FROM SIEMENS INDUSTRIES

TWIN 40-WATT AMPLIFIER

From Sony research... a totally new turntable system

Sony PS-4750

Superb Fidelity from Today's Most Advanced Direct Drive

Audio experts the world over have been waiting for it . . . Sony's incredible PS 4750, the ultimate turntable system.

State of the art takes on a new meaning with the PS 4750, probably the quietest turntable ever made.

In one elegant design Sony has reduced rumble, feedback wow and flutter to minute levels far beyond hearing and virtually beyond measurement. Wow and flutter for instance is an amazing 0.03% (wrms.) Signal to noise is better than 70 dB (DIN-B).

Sony achieved this in a number of ways:
First, all the belts, pulleys, idler wheels and other paraphernalia used in conventional turntables to make the turntable spin at the record's speed, instead of the motor's, have been eliminated.

The Sony PS 4750 has no need for these troublesome, noisy and fluttering parts, because its slow-revving D.C. motor is directly coupled to the platter.

Speed accuracy takes on new meaning with another Sony breakthrough, the "Magne-disc Servo Control."

Through a unique multi-gap head, this system automatically reads turntable speed through speed detective signals magnet-coated on to the turntable rim. Should there be any deviation induced by fluctuations in power supply, it immediately "instructs" the servo motor to make micro-accurate adjustments.

Another triumph of Sony research is the very material used to make the cabinet and turntable, B.M.C., developed specifically for audio use because its damping and resonance characteristics are 30 per cent better than the conventional aluminium diecast. B.M.C. is also virtually free of expansion or contraction, freeing the design of any problems arising from temperature changes.

Sony innovation didn't stop there. Look at the revolutionary rubber disc supports. These insulation mats are of a unique design which firmly grips the record, effectively insulating the disc from vibration when the turntable revolves. By preventing vibrations, these mats contribute to the stereo effect and significantly improve presence.

The precision tonearm is a universal type which accepts all quality shells and cartridges. Some of the Sony PS 4750's other advanced features are: stylus pressure adjustment (0-3 g), anti-skate compensator, viscous-damped (up and down) arm lifter, see-through stroboscope, independent pitch control (+ 4% on both 33⅓ and 45) and large insulator legs for effective prevention of audio feedback.

If you've been waiting for the ultimate turntable, you need wait no more. The superb Sony direct-drive PS 4750 is here.

SONY®
Research Makes the Difference

GAC.S.7532

ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 38 No 9

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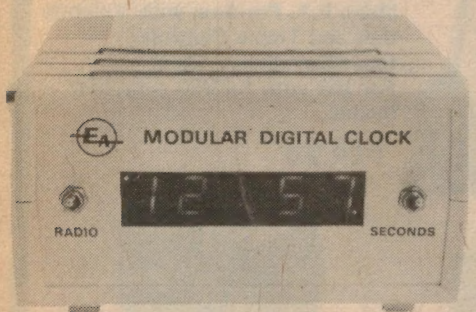


This is our latest digital clock, a versatile new design that's simple to build and easy to get going. The design offers several options, and can be expanded to include alarm, snooze, sleep and radio switching functions. We give you all the details in our article commencing on page 52.

Next month:

Microcomputers are now quite low in cost, but to use them you need a low cost terminal. Next month in EA we will present a new design for a low cost build it yourself video terminal, using any monochrome or colour TV set. Among its many attractive features are:

- Refresh memory of 1024 characters
- Three different display formats
- Crystal controlled, no setting up
- Serial interface at any of nine crystal-locked baud rates
- Both video and RF outputs
- Roll up and roll down facility.

All this at a price well below that of competitive terminals!

Don't miss our January issue for this trend-setting new project.

On the cover

Our cover picture this month shows the latest Siemens teleprinter unit, locally made at the Siemens plant in Richmond, Victoria. Some 25,000 Siemens teleprinters are now linked into the Australian telex and telegraph networks. (Photo courtesy Siemens Industries).

world of electronics and hi-fi

projects and technical

regular features

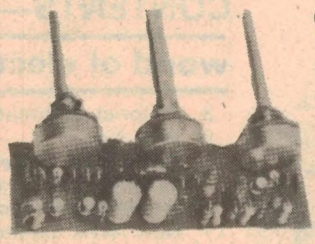
new

DOMINION electronic products

3000S-3 Channel Musicolor, an Audio Light Generator with a Sensitive Electret Microphone which picks up signals, and converts them into Electrical Impulses. Treble, Bass and Midrange controls with overall master contol. $88.50

AUSTRALIAN MADE

G30 — 25 Watt 2 Channel Guitar Amplifier with Tremelo Intensity & Speed Controls. $158.70

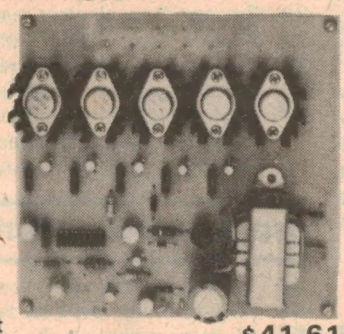


GV30

Mono P.A. Pre-Amp with Volume, Bass and Treble Controls.
Input Sensitivity: 2mV
For Use with KGV30 Amplifier Module.

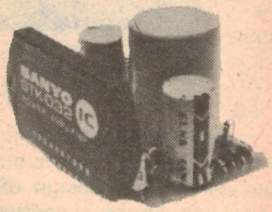
$19.20

GV30



$41.61

RL5 Sequential (Running) Lights, 5 Channels with control of Running Speed and switching sequence Max. 500 Watts per Channel.



KGV30 Power Amplifier Module

Output:	25 Watts R.M.S.
Input Sensitivity:	300 M.V.
Operation:	35 V A.C.

To suit speakers 4,8 or 16 ohms

$28.83

PRE-AMPLIFIER MODULES

MP47 MIC.

Rapar MP47 — Mic. Microphone pre-amp. Input impedance 47K Ohms. High impedance output.

$7.84

Rapar MP9 — Phono

Mono. Magnetic pre-amp. Input to suit magnetic gramo cartridge.

$7.84

MP200

Microphone pre-amp. Input impedance 200 Ohms. High impedance output.

$7.84

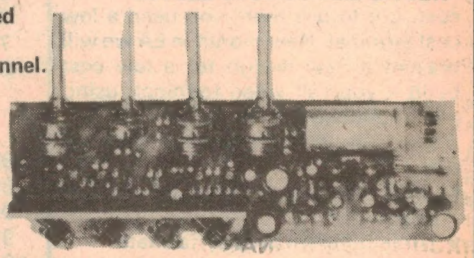
$10.14

Stereo pre-amp. Input to suit magnetic gramo cartridge.

$12.50

DM12 — Audible Deterent Noise Generators, 12V DC operation, Capable of driving up to 3 flares. Very Penetrating Sounds.

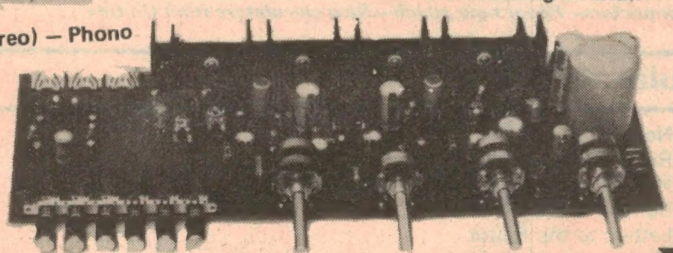
CSV222 STEREO AMPLIFIER



CSV22 — 12 Watts Rms per Channel with pre-amps to suit Magnetic Cartridge, with a frequency response from 20 - 25 KHZ. Total harmonic distortion less than .4%

$44.75

SMP9 (Stereo) — Phono



CSV50 — 25 Watts Rms per Channel Stereo Amplifier 2.5 MV Sensitivity to suit magnetic cartridge. Total Harmonic distortion less than .5% with Hi, Low filter monostereo switch.

$74.70

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Editorial Viewpoint

A threat or a challenge?

Broadly speaking, I think most people in electronics—whether hobbyist or professional—are fairly excited about microprocessors. This is probably because we are able to recognise that they are in fact a dual development.

We can certainly see that they are a further step in the evolution of conventional computers, a step which is lowering costs and thus bringing computing power right down into the mainstream of everyday life. But at the same time we can also see that they are a logical development of large-scale integration technology, a development which will probably broaden the range of dedicated electronic controls and systems a thousandfold.

It is this second aspect of microprocessors which is mainly responsible for the current revolution in electronics, not the first. If the only benefit of microprocessors was cheaper and more accessible "number crunchers", they would'nt be making the impact they are. And we in electronics wouldn't be in the midst of planning for an exciting new era.

Why I mention all this again is that I have been intrigued lately by the attitudes and reactions towards microprocessors displayed by many people in the existing computer industry. Both from talking to them, and from reading industry publications, I have the impression that quite a few computer professionals are either apathetic or patronisingly disdainful.

At first I found these reactions rather puzzling, but now I think I understand.

For the last 15 or 20 years, computer professionals have been able to establish themselves comfortably as an indispensable elite: a white-coated priestly caste, whose mysterious ministrations were deemed essential if computers were to perform anything useful. The arrival of minicomputers tended to weaken this elite image a little, as they proved capable of being driven effectively by mere electronics engineers and technicians. But by and large, any computer facility worthy of the name still needed its retinue of systems analysts, programmers and other assorted boffins.

Then along came these horrid little microprocessors, with their obvious implications of low cost computing facilities within reach of almost anyone—even hobbyists and school students!

It's understandable, then, that some computer people aren't nearly as keen about microprocessors as we in electronics tend to be; the new devices are seen as a threat to their future status and well-being.

Of course the truth is that computer folk and their accumulated experience are going to be invaluable as we enter this new phase of computing and electronics. They may have to change a little, and accept a less mystic image. But on the other hand we in electronics are having to change too—and among other things, we are having to learn basic programming!

If we work together, I think the future should be very rewarding for us all—and for humankind.

That optimistic note seems to lead on to my final thought, which is not about microprocessors at all. On behalf of all of us here at EA, I wish you a very merry Christmas, and a happy and prosperous new year.

—Jamieson Rowe

ON SALE THE FIRST MONDAY OF EACH MONTH

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A range of highly sophisticated tape recorders and decks . . . seven models to select from. One for every need and budget. For instance, the new 1140 . . .. Dokorder's finest professional tape deck. Studio quality and a host of features. And the 8140 4-channel tape deck with multi-sync, for fun, flexibility and fine sound. Then, there's the new MK550 stereo cassette deck featuring servo controlled drive system, built-in Dolby, Cue and Review system, Peak Level Indicators, Normal/Chrome equalization and a switched FM multiplex filter–features you should insist on in any first-class deck.

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Dokorder.

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PA11D

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New Peerless Orthodynamic principle– this is really living

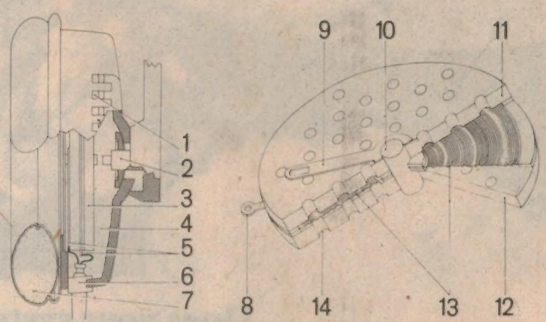
With Peerless PMB6 headphones everything you hear is true. Based on the newly developed and patented Peerless Orthodynamic principle, PMB6 headphones deliver reproduced sounds equal in quality to the most sophisticated electrostatics. Peerless bring it back alive–sounds so real, you feel you're actually there.

In one ear and in the other– in total comfort

There's nothing more annoying than headphones that clamp you in a head-lock.
With Peerless featherweight construction, fine fit and pillow-soft ear pads, absolute comfort is certain over long time listening.

Until you've heard it through Peerless– you just haven't heard it!

Between two perforated ferrite magnet discs lies an ultra thin diaphragm/voice coil. This light and very elastic diaphragm, whose total surface is put into motion, makes crystal clear high frequency reproduction possible. Its construction also ensures uniform phase characteristics and low distortion. The diagram below details this novel new design.
In your favourite piece of recorded music, you'll hear notes and nuances you'd never have believed existed.



1. Air holes. 2. Ball joint suspension. 3. Drive unit. 4. Damping material. 5. Terminals. 6. Cable grip. 7. Ear pads. 8. Terminal. 9. Terminal. 10. Centre axle. 11. Magnet. 12. Magnet. 13. Diaphragm/voice coil. 14. Hole in magnet.

Peerless PMB6 Technical Data

Frequency:	Range 16-20,000 Hz
Impedance:	140 Ohms
Max. Constant Load:	40 dB
Operating Power:	2.5 mW
Distortion:	1%
Rated Input:	2W (DIN)
Weight:	210 g
Colours:	Black, Red and Olive Green

Peerless PMB6 $49

Electrostatic quality, superb comfort and a realistic price

Peerless

Danish Hi Fi Shop 9, Southern Cross Hotel, Melbourne. Telephone 63 8930. **Danish Hi Fi** 698 Burke Road, Camberwell, Victoria. Telephone 82 4839. **Convoy Sound** 1 Maclean Street, Woolloomooloo, N.S.W. Telephone 357 2444. **Convoy Sound** 387 George Street, Sydney. Telephone 29 4466. **Brisbane Agencies** 72 Wickham Street, Fortitude Valley, Queensland. Telephone 221 9944. **Danish Hi Fi** 308 Walcott Street, Mt. Lawley, Western Australia. Telephone 71 0100.

Does your system hunger for one?

Hi fi systems also need the right kind of nourishment. One of the most effective ways of providing it is featured above: the AKAI AA-1020 AM/FM Tuner Amplifier.

It puts out 20 effortless watts RMS per channel (both channels driven, from 20 to 20,000 hz, no more than 0.4% THD into 8 ohms load). It comes with the kind of facilities that produce the best kind of sound. And at $340†, the price isn't likely to turn you off.

But maybe your system hungers for a lot more power, in which case you should see our more powerful models.

Of course, like all AKAI hi fi equipment distributed by AKAI Australia, it comes with our Complete Protection Plan*. Which simply means 12 months full parts and labour warranty on all Tape Equipment, 2 years full parts and labour warranty on all Amplifiers, Turntables and Speakers and a lifetime warranty on all GX Tape Heads.

So, if your amplifier isn't all it should be, see your AKAI dealer. He'll put your mind at ease.

The AKAI Hi-Fi Professionals are: **NEW SOUTH WALES — SYDNEY CITY AND METROPOLITAN. Sydney:** Douglas Hi-Fi, 338 George Street; Duty Free Travellers Supplies, 400 Kent Street; European Electronics, 187 Clarence Street; Instrol Hi Fi, Cnr. Pitt & King Streets; Magnetic Sound Industries, 32 York Street; Jack Stein Audio, 275 Clarence Street. **Bankstown:** Selsound Hi Fi, Cnr. North Terrace & Apian Way. **Burwood:** Electronic Enterprises, 11 Burwood Road; Edge Electrix, 31 Burwood Road. **Concord:** Sonarta Music Services, 24 Cabarita Road. **Cremorne:** Photo Art & Sound, 287 Military Road. **Crows Nest:** Allied Hi Fi, 330 Pacific Highway. **Hurstville:** Hi Fi House, 127 Forest Road. **Liverpool:** Miranda Stereo & Hi Fi Centre, 166 Macquarie Street. **Miranda Fair:** Miranda Hi Fi & Stereo Centre, Shop 67, Top Level. **Mona Vale:** Warringah Hi Fi, Shop 5, Mona Vale Court. **Parramatta:** Gramophone Shop, Shop 151, Westfield Shoppingtown; Selsound Hi Fi, 27 Darcey Street. **Roselands:** Roselands Hi Fi, Gallery Level. **South Hurstville:** Selsound Hi Fi, 803 King George's Road. **Summer Hill:** Fidela Sound Centre, 93B Liverpool Street. **Sutherland:** Sutherland Hi Fi, 5 Boyle Street. **Waitara:** Hornsby Hi Fi, 71 Pacific Highway. **Westleigh:** Sound Incorporated, 16 Westleigh Shopping Centre. **NEW SOUTH WALES COUNTRY. Albury:** Haberecht's Radio & TV, 610 Dean Street. **Bega:** Easdowns, 187-191 Carp Street. **Bowral:** Fred Hayes, 293 Bong Bong Street. **Broken Hill:** Pee Jay Sound Centre, 364 Argent Street. **Gosford:** Gosford Hi Fi, 163 Mann Street; Miranda Stereo & Hi Fi Centre, Cnr. Donnison & Baker Streets. **Moss Vale:** Bourne's Merchandising, 1 White Street. **Newcastle:** Ron Chapman Hi Fi, 880 Hunter Street; Eastern Hi Fi, 519 Hunter Street. **Nowra:** Nowra Hi Fi, Shoalhaven Arcade. **Taree:** Taree Photographics, Graphic House, 105 Victoria Street. **Wagga Wagga:** Haberecht's Radio & TV, 128 Baylis Street. **Wollongong:** Hi Fi House, 268 Keira Street; Selsound Hi Fi, 2-6 Crown Lane. **A.C.T. Civic:** Allied Hi Fi, 122 Bunda Street. **Fyshwick:** Allied Hi Fi, 3 Paragon Mall, Gladstone Street. **QUEENSLAND. Brisbane:** Chandler's, 120 Edward Street; Chandler's, 399 Montague Road, West End; Stereo Supplies, 95 Turbot Street; Tel Air Electronics, 187 George Street. **Nambour:** Custom Sound, Currie Street. **Mt. Isa:** The Sound Centre, West Street. **Rockhampton:** Chandler's, 144 Alma Street. **Southport:** Stokes Electronics, Scarborough Street. **SOUTH AUSTRALIA. Adelaide:** Ernsmiths, 48-50 King William Street; Flinders Trading Co., 55 Flinders Street; J B Electronics, 115 Gouger Street. **Blackwood:** Blackwood Sound Centre, 4 Coromandel Parade. **Glenside:** Steiner Electronics, Conygham Street. **Moana:** Bob Carmen, 185 Commercial Road. **VICTORIA. Melbourne:** Douglas Hi Fi, 191 Bourke Street; **Warrnambool:** A. G. Smith, 159 Liebig Street. **WESTERN AUSTRALIA. Perth:** The Audio Centre, 883 Wellington Street. **Calista:** Hub Hi Fi, Kwinana Hub, Gilmore Avenue. **East Victoria Park:** Japan Hi Fi, 889 Albany Highway. **Nedlands:** Audio Distributors, Broadway Shopping Centre, Broadway. **Midland:** Midland Audio, 16B Great Northern Highway. **Mosman Park:** Audio Distributors, 14 Glyde Street. **W.A. COUNTRY. Bunbury:** Aabel Music, 130 Victoria Street. **Kalgoorlie:** Hambley's Hi Fi, Shop 13, Central Arcade, Hannan Street. **TASMANIA. Burnie:** James Loughran & Sons, 29-31 Wilmot Street. **Hobart:** Quantum Electronics, 181 Collins Street. **Launceston:** Wills & Co., 7 Quadrant. **NORTHERN TERRITORY. Darwin:** Pfitzners Music House, Smith Street.

AKAI

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*The Complete Protection Plan does not cover equipment purchased outside Australia. †Recommended retail price only.

70613R

- □ - 80 dB rumble
- □ 0.04% wow and flutter
- □ continuously variable speed range through a servo controlled d.c. motor...
- □ push-button selection of 78, 45, 33⅓ r.p.m.

does this make the ultimate turntable?

Fons gives you that and more.

At $289 R.R.P. with base and cover, or only $479 complete with base, cover, S.M.E. 3009 arm and Stanton 681eee, how can you resist.

P.S. If this isn't the ultimate turntable, we'd like to know why.

* Measurements taken from authoritative U.S. "F.M. Guide" May 1976.

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You've just said a mouthful. Now send me my JBL T-Shirt, I enclose $5.00 for each one making my cheque/money order $ . . .

My size is
Large ( ) T-Shirts
Medium ( ) T-Shirts
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Her size is . . . . . ( )
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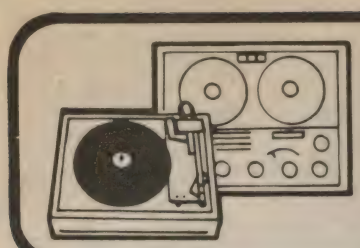


Hi Fi News

AIWA wants some of the hifi action

Reflecting yet another significant move on the local hifi scene, AIWA Australia Pty Ltd are beginning to make their presence felt with an approach to selected dealers throughout Australia and with new-image publicity headed up by colour commercials on major TV channels.

by NEVILLE WILLIAMS

To talk with AIWA Australia's General Manager, Ian Woodhouse, is to receive the multi-message: AIWA is big in hifi, and especially in cassette players; AIWA has a whole string of new quality products in the pipeline; AIWA products will be available where and when you want them; AIWA is aiming to give the best and fastest back-up service in the business.

Behind the local enterprise is the parent company in Japan, whose name bears an unfortunate resemblance to the initials of Amalgamated Wireless (Australasia) Ltd. Perhaps that's why the television adverts tend to stress the pronunciation "Ay-ee-wah". Around the company headquarters itself, however, you are more likely to hear just plain "Eye-wah".

Take your pick, as long as you don't say: "A . . W . . er . . I . . er . . A"!

When the Company was first founded in Japan in June 1951, it was registered under the name Aiko Denki Sangyo Kabushiki. With a capital of one million Yen, its stated purpose was to manufacture and sell radio receivers and other communications equipment. In fact, the initial effort gravitated towards the production of carbon, crystal and moving coil microphones, of which the DM-1 dynamic became the best known. In 1955, the variable reluctance mono phono cartridge also attracted a lot of attention.

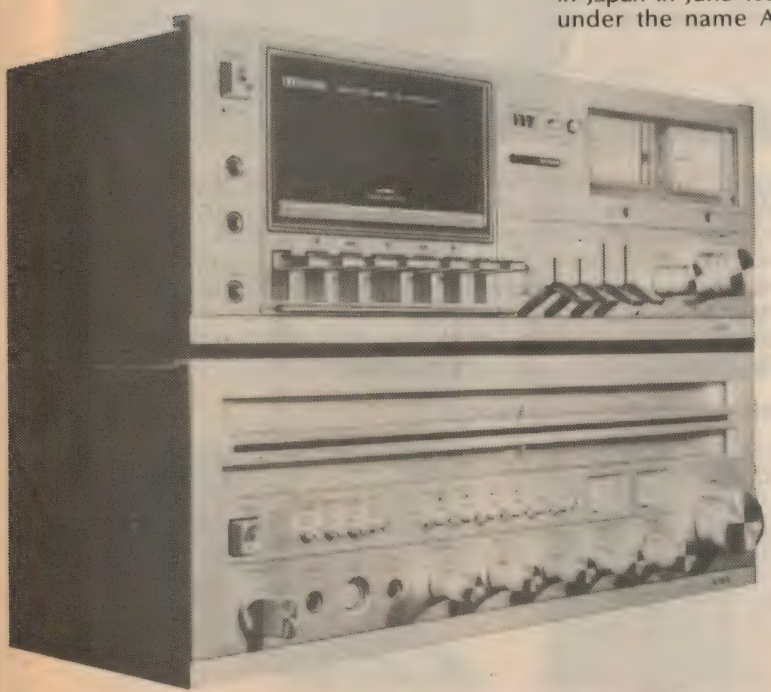
NHK – The Japanese National Broadcasting Network – subsequently appointed Aiko Denki as its leading technical study factory and this, together with a move into higher quality ribbon microphone manufacture, necessitated successive increases in capital to 100-million Yen in 1959.

The same year saw the Company name change to AIWA Co Ltd, followed by a trebling of capital, listing on the Tokyo stock exchange, and the establishment of a major subsidiary in Chicago, USA.

1964/5 saw the development and marketing of Japan's first compact cassette tape recorder/player, using the then new Philips cassette format. About the same time, Japan's first unidirectional moving coil microphone appeared, the DM-47. Since then, AIWA have developed and marketed a wide variety of cassette recorders and players, ranging from straight portables, through cassette/radios, car cassettes and cartridge players, to modern stereo cassette decks, and integrated entertainment centres: cassette/disc/receiver/amplifier in one assembly.

AIWA products tended to filter on to the Australian market relatively early in the Company's history. Many will remember the DM-1 moving coil microphone, while the DM47 was very popular for sub-professional P.A. applications, by reason of its directional qualities and the advantage it gave in potential acoustic feedback situations.

Until fairly recently, AIWA products were distributed in Australia by Goldring and, in this era, the AIWA name became



Featuring prominently in AIWA's current publicity is the AD-6500 front loading cassette deck (top) which features automatic loading and illuminated cassette aperture. It has all normal facilities including Dolby-B and provision for three grades of tape, excellent specifications and a front panel DIN socket for easy access. The matching AM/FM stereo receiver below, type AX-7500, has full access and control facilities and a rated output of 33W RMS per channel into 8 ohms.

Photographed at an AIWA dealer presentation at the Sydney Opera House: Centre is AIWA Director Mr Hiroshi Kohjimoto, and left Mrs Harume Kohjimoto. On the right is AIWA Managing Director for Australia Mr. James D. Cobb.

largely synonymous in Australia with portable radios and cassette radios. The fact that AIWR also manufactured up-market stereo equipment was less well known.

When AIWA Australia Pty Ltd was established in late 1975, one of the first objectives was to extend the Company image in Australia to the other end of the market spectrum; to ensure that AIWA was represented in the hifi salons with appropriate product lines, as well as by battery portables in the department stores. In fact, the "portable" lines are being deliberately rationalised to simplify marketing—and customer choice—in this area.

Meanwhile, the Australian Company headquarters at 14 Gertrude St, Arncliffe, NSW is rapidly taking on the character of the new-look organisation.

Along one side of the upstairs showroom is a display of the smaller items which have long been associated with the AIWA name in Australia, ranging from a first-size cassette recorder player, through conventional portable tape players to a 4-speaker compact system intended for small flats and home units; from routine portable receivers to multi-band receivers intended for the enthusiast and ethnic DX and short-wave listener market.

Along the other side of the showroom are racks of hifi stereo cassette decks, top loading, inclined panel loading, and front loading—including the nifty automated system being featured in the TV commercials. AIWA are more than happy for the specifications to be compared with those of comparable models from other manufacturers.

As well, there are amplifiers, receivers and integrated cassette/receivers, a belt-driven turntable and a range of loudspeaker systems, which is in the course of being expanded.

Downstairs, there is a service centre, spare parts and bulk stores, staffed by technical people familiar with the AIWA range of products.

And elsewhere in the building—we almost forgot—are the—administrative offices!

As Managing Director J.D. (Jim) Cobb is not backward in reminding hifi dealers around Australia: AIWA is into the prestige market, boots and all!

GOLDRING DOING THINGS IN STYLI!

According to Mike Dean, General Sales Manager for Goldring Sales & Service Pty Ltd, his company will be placing renewed emphasis on the sale of replacement styli and pickup cartridges. Typifying their approach, the Company operated a stylus advisory centre at the Sydney Consumer Electronics Show, using an inspection device which gave a 200-times up view of suspect stylus tips. Goldring is planning a series of in-store promotional and educational centres to alert record users to the need for regular stylus inspection and replacement. (Goldring Sales & Service Pty Ltd, 26-28 Ricketty St, Mascot 2020.)

DECCA CASSETTES

Our article in the October issue of "Electronics Australia", about the disappointing quality of many pre-recorded cassettes, was mirrored in the American "Audio" magazine for the same month. On the basis that the average pre-recorded cassette compared poorly with its disc counterpart, columnist Bert Whyte was most interested to attend a demonstration in New York of upgraded cassettes being released under the "London" label.

As Bert Whyte points out, this is the label used in America for releases by British Decca. One of the prominent figures at the New York Demonstration was none other than Arthur Haddy, the man largely responsible for Decca's notable ffrr discs, which immediately preceded the microgroove era.

Guests at the demonstration were invited to compare directly the new London/Decca cassettes with 15ips copies of the same material, being free to check levels and operate the A/B switching to suit themselves. While Bert Whyte had some reservations about the choice of loudspeakers and the characteristics of the hotel room involved, there seemed to be little doubt that the new cassettes were way above average.

This was confirmed when Bert Whyte was able to play a selection of the London/Decca cassettes on his own equipment and share reactions with other expert listeners.

Out of this came the very natural question: what was the explanation for the apparent improvement in quality? While various companies had made conscious efforts, in the past to improve the quality of pre-recorded cassettes, in general they had tended to come unstuck for economic reasons. As a result, cassettes have tended to gravitate to a level adequate for casual listening but short of

Miniature mic. for home moviemakers

With a diameter of 18mm and a depth of 9mm, Sennheiser's new MKE 10 "Micromike" (left) should appeal to home moviemakers and others who need a microphone small enough to pin unobtrusively to clothing. An electret type with omnidirectional pickup, it can be used directly with any tape recorder with a DIN 45 594 input with integral DC supply connection. Where this is not available, one or two Micromikes (for stereo) can be used with the slim battery supply module shown to provide signal for normal inputs. The Micromike is due for release in January 1977. (In Australia: R. H. Cunningham Pty Ltd, 493-499 Victoria St, West Melbourne.)

A screwdriver and about ½ an hour is all you need to build this 40 watt Philips speaker system.

Philips make it easy and inexpensive for you to own a professional speaker system. Assemble it yourself in about 30 minutes and you have 40 watt (RMS) capacity speakers to complement your hi-fi gear.

The AD8K40 Speaker Kit includes:

- 2 precut, pre-finished wood grain cabinet enclosures with pre-painted baffle boards.
- 2 mounted grill cloths with pre-painted baffle boards. • 2 x 8" woofers. • 2 x 1" dome tweeters.
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accepted domestic hifi standards.

It transpired that Decca's cassette production is concentrated in the village of Bridgenorth, 140 miles north of London and not far from the Welsh border. And the quality of the cassettes that emerge from the Bridgenorth complex is not the result of any revolution in technology, but of meticulous attention to detail and quality control.

In one of its other facilities, Decca makes its own cassette shells, with due attention given to something like 400 dimensions, all likely to have some affect on the behaviour of the tape—as evidenced in wow and flutter on the user's deck. For the same reasons, the shells are ultimately welded together rather than screwed, because Decca research suggests that screwing produces more stresses, with a greater chance of misalignment.

Inside the shell, guide rollers have been replaced by solid posts of slippery Delrin, eliminating another source of erratic tension, due to eccentric rollers or sticky bearings. A special graphite coated liner provides further lubrication and control, while tiny aluminium rods, press fitted into slots in the hub, provide a highly controllable method of locking the tape to the spools.

As a result of these measures, Decca claim a particularly low figure for azimuth error or tape wander—therefore for mistracking at the highest frequencies—no matter what the physical position of the cassette.

The surprising thing, however, is that Decca have made no concession to copying speed, which might prejudice unit production cost. The slave tape runs at 60ips, or 32 times normal speed, while the bias oscillator operates at 10MHz.

However, while the technology and equipment is routine enough, Decca engineers rework the decks before they are put into service, mounting special ferrite heads on adjustable plates which permit ultra-fine setting of azimuth. As well, the tape guidance components are modified to reduce the abruptness of direction changes and to improve the intimacy of contact between tape and head.

The tape itself is selected to suit, not only the equipment, but the nature of the program to be recorded. At the time of reporting, Decca was using either BASF duplicating tape or a high energy grade of Memorex, giving an extra 8dB of headroom.

Full Dolby-A is used for the running master, being decoded to Dolby-B for the cassette copies actually sold over the counter.

Experience would seem to indicate that Dolby-B is not a panacea for all recording ills and, if used carelessly, may cause as many problems as it cures. But

CENTREX: Quality sound on the move

Curiously, while AIWA Australia are expanding up-market (see preceding pages) Pioneer Electronics Australia are looking the other way. Already well established in the domestic hifi market, they have launched into the portable and "transportable" market with Centrex (by Pioneer): "Quality sound that moves around".

Pictured above is the most "domestic" of the new Centrex products—an AM and FM/stereo receiver with in-built stereo cassette recorder/player and a "piggy-bank" 3-speed record changer with magnetic cartridge and diamond stylus. Power output is a modest 4W RMS per channel but it has all the facilities necessary for disc or cassette listening in a flat or small home unit. Price, complete with a pair of 2-way speaker systems, is $449.

Simplest of the portable cassette receivers (top right) is the RK-112, which has a recommended retail price of $99. It offers coverage of the normal AM band (525-1630kHz), the FM band in mono mode (88-108MHz), in-built mono cassette record/replay deck, in-built mic. and provision for external mic. Powered from four 1.5V D cells, or from the mains, it is credited with an output of 2.3W "music power". Other features include tape auto stop, automatic recording level control, and a "sleep" function.

The RK-222 (centre right) has the same general styling as the RK-112 but has more facilities and retails at $135. Additional facilities include a short-wave band (5.9-16MHz), microphone mixing, tape footage counter, and battery and level meter.

The present top-of-the-line Centrex portable is the RK-888 (bottom right). It has a quite different styling with slide controls and a facia that is akin to a domestic cassette/receiver. Apart from the more ambitious styling, it offers higher specifications, separate bass and treble controls, a memory style counter, and a two-way loudspeaker system. Recommended retail price is $195.

Centrex will be available initially in New South Wales and Victoria, with other states to follow later in the new year. (For further information: Rod Knapp, Pioneer Electronics Australia Pty Ltd, 178-184 Boundary Rd, Braeside, Vic. Phone (Melbourne) 90 9011.)

BOGEN/TECH-CRAFT NOW HANDLED BY AUDIO TELEX

A new name—Tech-craft—and a whole range of new look professional equipment is currently being introduced on to the Australian market by Audio Telex Communications Pty Ltd. But behind the new name is a very old one, Bogen (now the Bogen Division of Lear Siegler Inc.) a major supplier of quality audio equipment in the USA since 1932.

In their newly announced Tech-craft product line, Bogen have drawn on their expertise in the hifi field to exploit the "system" approach, in which the amplifier is regarded as central, other peripheral equipment being designed to be compatible with it. The policy ensures, at the one time, flexibility, along with a predictable high quality end result.

The Tech-craft range is therefore seen as ideal for professional use in auditoriums, concert halls, theatres, churches, sporting arenas, &c—in fact, anywhere the need arises for high quality sound reinforcement.

Tech-craft amplifiers are available in three power ranges, 60, 125 and 250 watts. With continuous professional rating at +55°C ambient air temperature, they produce less than 1% total harmonic distortion from 25 to 22,000Hz. All the amplifiers offer 25V or 75 volt output, as well as a direct output. The amplifiers are designed for standard 19" rack mounting and have a brushed nickel steel finish.

Two Tech-craft mixer/amplifiers are available, the smaller TCM 100 providing four mic inputs, one convertible to line and one high level input. Its big brother, the TCM 200, is designed to handle 8 inputs each controlled by linear slide pot and capable of handling almost any type of audio input by means of plug-in modules. Each input channel has an LED overload indicator and a 30dB continuously variable attenuator to adjust for peak overload. Both mixers feature active mixing, with negligible interaction between inputs. In fact, the microphone channel isolation is 80 dB. Both mixers feature large illuminated VU meters and multi channel input extenders.

Another unit designed expressly for the Tech-craft sound reinforcement chain is the ⅓ octave equalizer model TCE 200. It contains 24 filter sections providing up to 14 dB of either boost or attenuation in ⅓ octave increments. Its rated output is 18 dBM into a 600-ohm load with less than .5% distortion; residual noise is 80 dB below the rated output. Like other Tech-craft products in the range the unit operates from either AC or DC

Other Tech-craft components include compressor/line amplifier model TCC 200, 150 watt mono/stereo bi amplifier model TCB1/150 and two mixer power amplifiers, Model TCA 60 and TCA 125.

From the top: A Tech-craft dual concentric loudspeaker; the TCM 200 8-channel mixer; TCB 125 125W solid-state power amplifier; TCE 200 spectrum equaliser.

Rounding out the Tech-craft line are 23 loudspeaker system components including 3 compressor drivers, 4 radial horns, 3 multi-cellular horns, 3 low frequency speaker systems, 1 wide-range three-way speaker system, two co-axial loudspeakers, and the required crossover networks and hardware. This wide range of components will fill system requirements from the smallest rooms to stadiums with equal compatibility.

The Bogen-Tech-craft range of sound products are distributed in Australia by Audio Telex Communications Pty Ltd., 54 Alfred St, Milsons Point, Sydney. Also at 828 Glenferrie Rd, Hawthorn, Vic.

HIFI NEWS—continued

Dolby-B processing, climaxing the kind of quality control that Decca are apparently seeking to maintain, can well add the final touch of lustre.

An agreement signed recently in Japan gives the Components Division of Plessey Australia sole Australian distribution of the internationally-known Foster and Fostex loudspeakers.

The Foster Electric Company has five plants in Japan and others in Singapore and Taiwan. Contractors for sound equipment installed in the Sydney Opera House chose Foster speakers and more are being supplied through Plessey.

The company produces loudspeakers —from paper pulped for the cones to the end product—ranging in size from 25mm horn tweeters to 305mm ones for amplifying guitar music.

As well as Foster speakers for general purpose, hi-fi and on-stage music amplification, Plessey will also market the Fostex range designed for the ultimate hi-fi enthusiast.

The agreement—described by Mr Wes Oliver, manager of Plessey electronic components, as most important to his company—will strengthen Plessey in the audio field.

Importation of the high-quality speakers is linked with two other moves by Plessey in the audio business—a new range of Garrard turntables and modules (available early in 1977) and improved versions of the complementary range of locally assembled enclosed speakers.

Earlier in the year, we drew attention to the anomaly arising from the practice of supplying hifi equipment fitted with 2-wire power cord and a 3-pin plug.

It was with interest, therefore, that we received the following advice from Pioneer Electronics Australia Pty Ltd, over the signature of their Publicity/Promotions Officer, Mr. R. Knapp:

"In recent months the desirability of using 2-pin mains plugs and 2-wire leads in hi-fi equipment has been questioned.

"Pioneer Electronics Australia Pty. Ltd. have been acutely aware of this and are currently taking action to rectify the situation.

"By the end of this year all Pioneer Hi Fi equipment, designed for the Australian market, will be fitted with approved 3-core Mains Flex and 3-Pin Plug."

WHERE THERE'S A NEED THERE'S A STANTON

Stanton have always satisfied the needs of those whose job it is to play records — of any sort. Here are some of the specific record playing tasks Stanton have been called on to cope with:—

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Stanton developed specific cartridges and styli to satisfy these needs.

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Accepting the challenge, Stanton produced the 680EE. It has many of the universally acclaimed qualities of the 681EEE. It tracks at the same pressure as the 681EEE (0.75—1.5 gms) it has the same unsurpassed channel separation of 35dB (at 1KHZ) and its frequency response is almost as wide.

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N.S.W. Office: 100 Walker Street, North Sydney, N.S.W. 2060. Phone 922 4037.

Victoria Office: 103 Pelham Street, Carlton, 3053. Phone 347 7620.

Available at quality-conscious Hi-Fi dealers throughout Australia.

LER 149

SONY HI-FI NEWS No3

New from Sony: Front loading Cassette Decks

TC 206SD

Sound that rivals reel-to-reel in a space only one sixth as high.

Sony's new front loading cassette decks are loaded with features. For example the TC 206SD with full range separate bias and equalisation selectors to handle high quality ferric, chrome dioxide and Sony's superb double coated ferri-chrome cassettes. Fully flexible Dolby* controls with multiplex filtering to get the best from FM broadcasts. LED peak indicator as well as easy to read VU's. Automatic shut off. Lockable pause key for precise cueing. Sony's famous long life Ferrite and Ferrite head. Illuminated cassette well and upright tape positioning for easy viewing of cassettes. Featuring the new 'Soft Eject' mechanism.

And the sound? Strictly 'Front of the House'. Virtually linear smooth response over a tremendous range of 20-16,000Hz ($Fe C_r$, C_rO_2 tape). Wow and flutter at reel-to-reel standard of 0.08%. Signal to noise – an amazing 59dB.

If you want space saving, front-loading convenience and quality sound, check the range of Sony cassette decks soon; the TC 206SD for superb sound, the TC 209SD strictly for connoisseurs with specifications to match. And the budget priced TC 186SD for Sony quality – at a significant saving.

*Dolby is a trademark of Dolby Laboratories Inc.

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GAC S 7834

New AWA monitor uses duplex woofers

A new loudspeaker system currently under development by AWA employs a novel variant of the reflex principle, to obtain a response down to below 30Hz in an enclosure of moderate size, together with good efficiency and high power rating. Designated as AWA type DD88M, it is envisaged as a professional monitor, or for high quality reproduction in the home.

By NEVILLE WILLIAMS

A front view of the DD88M monitor, with fret removed. Note the recessed woofers and the port, which also serves as a base.

During the last decade, research into drivers and enclosures, much of it originating in Australia, has taken most of the guesswork and the folklore out of loudspeaker system design—at least as far as the bass end is concerned. It has reached the stage where, as recently reported, procedures devised by Australian engineer Neville Thiele have been translated by Wharfedale of England into a computer program. On request, the computer can print out a range of options covering driver and enclosure parameters and the related frequency response characteristics.

While such methods can predict quite reliably how a proposed system will behave in the bass register, they certainly cramp the style of an engineer trying to dream up a new and more saleable product. He can play around to his heart's content in the middle and top register and do all sorts of things in terms of presence, directionality, phase linearity and so on; but the bass characteristic will be the predictable outcome of whatever set of compromises he settles for.

Some twelve months ago, while the rest of the Ashfield staff were enjoying annual leave, AWA's long-time loudspeaker engineer, Wal Barlow, was pondering the vexed question of how he might manipulate established design parameters to end up with a system which would go down reliably to at least 30Hz, without incurring the likely penalties: prohibitively expensive driver(s), unduly large enclosure, or embarrassingly low conversion efficiency.

Behind the exercise was a liberal helping of good, old-fashioned purist pressure. If one examines the response curves of typical modern hifi loudspeaker systems, the majority of them do indeed have a fairly flat response down to a deliberate "corner" frequency, below which output rolls off at either 6dB or 12dB per octave. The problem is that the corner frequency is usually in the range 70Hz to 40Hz, rarely going below that.

Figures near the top end of the range are justified on the basis that they represent the best possible compromise, for a given design, between size, sensitivity and power handling capability. Figures at the lower end of the range are justified on the basis that musical frequencies below 40Hz occur only rarely, and not at all in a large amount of typical program. But, in any case, a system with a smooth response and roll-off can be assisted by a discrete amount of bass boost in the amplifier.

But, whatever the truth behind this kind of rationalisation, it never really satisfies the dyed-in-the-wool purist. If theory suggests that some program material will contain frequencies down to 30Hz, then that's what the loudspeaker system should be designed for—without the aid of bass boost and despite the limitations of typical listening rooms!

And that's the kind of pressure that was behind Wal Barlow's initiative.

What emerged from it all was the novel approach behind the AWA DD88M monitor—not an idea that contravened theory but one that managed to manipulate the parameters towards the desired end result.

Fundamental to the proposition was the assumption that any system which might meet the objectives, would be a reflex design, because of the vital contribution that a port can make to output and efficiency at the bottom end. Flowing from this assumption, Wal Barlow worked through the conflicting considerations—and they are summarised below from the DD88M background literature:

ENCLOSURE VOLUME: The larger the enclosure, the less it tends to push up the natural resonance of the selected driver. However, enclosure size is limited by customer demand, which tends to taper off with increasing enclosure size and mass. Price is also a deterrent, because it costs more to manufacture, package, store and deliver large and rigid enclosures.

CONE AREA: A small cone is less affected by an enclosure of limited size than a large cone, making it possible to achieve a lower corner frequency. However, to move a given volume of air, thereby producing a given sound level, a small cone has to travel through a greater distance than a large cone; this imposes its own problems and limitations. Beside that, small cones tend to have less customer appeal.

CONE STIFFNESS & MASS: Both are involved in determining the driver's natural bass resonance. The cone suspension must exhibit reasonable ruggedness and an adequate restoring force for mechanical reasons, resulting in some "stiffness"; too much stiffness, however, raises the resonance unduly, making it difficult to design for a smooth, extended response. Higher cone mass has the opposite and desirable effect of lowering the natural cone resonance but it must be matched by an increase in the magnetic circuit flux in order to ensure adequate electrical damping and to prevent the development of bass "boom".

MAGNETIC FLUX: Most high quality drivers already have more ambitious and costly magnetic systems and there may not be scope to increase the magnetic flux to match any significant increase in cone mass. In fact, the magnetic circuit of most high quality

Illustrated above: the fully automatic model number 9341. Also available, the semi-automatic model number 9361

The Luxor 'Swedish Sound'

A superb range of record players designed for precision and reliability from Sweden's largest manufacturer of high-quality stereo systems

In 1923, at Motala in Sweden, Luxor first began serial production of radio sets. Since that time, Luxor have grown to be, among other things, Sweden's largest-selling range of record players.

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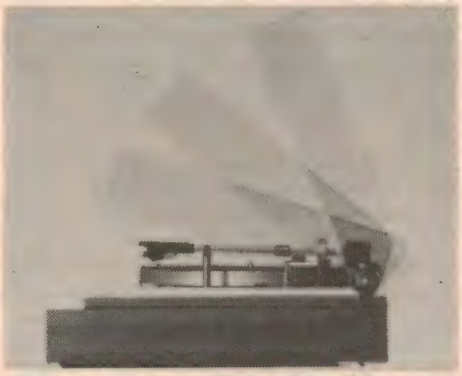

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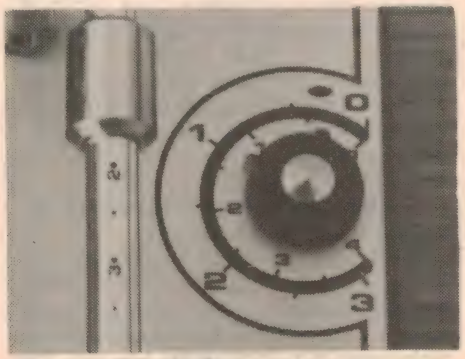

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Special features include a 16-pole synchronous motor and belt-drive for low wow and flutter. And switchable automatic stop which completely disengages the pick-up-arm.

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AWA MONITOR USES DUPLEX WOOFERS

speakers is already saturated, so that a further increase in cone mass is really not an option.

Faced with these limitations, the hopeful designer would seem to have little room to move, but Wal Barlow came up with a novel answer which is currently the subject of a patent application. He simply took two suitable bass drivers and mounted them face to face on the enclosure baffle, supplying them with signals of opposite phase, so that both cones move in the same direction.

By so doing, he produced a composite bass driver referred to in the patent documents as "Duplex Drive". It has the following interesting characteristics:

- Double the stiffness of either driver alone. This is counter-balanced by:
- Double the mass, since the composite cone is really two cones, plus a small amount of air trapped between them. These two effects combine to produce:
- The same fundamental bass resonance as either driver alone. But the modified characteristics—more stiffness, more weight—both tend to make the driver less affected by enclosure volume. As a result:
- Enclosure design can be guided towards a lower corner frequency for a given internal volume than would be possible with only one of the composite pair. And fortunately:
- Magnetic damping is maintained at the correct level because there are two distinct magnetic circuits to cope with the extra mass.
- Linearity appears to be improved because the cones are operating virtually in push-pull, with a tendency to cancel non-linear suspension characteristics. Another bonus is that:
- The soft surround tends to be blown less by air pressure, each surround being protected by the other.

The enclosure, as pictured, was a prototype submitted for our comment; the final DD88M may exhibit some cosmetic changes. It measures 765mm high x 460mm wide by 335mm deep and weighs 29kg. As such, it is a fairly typical free-standing system, certainly larger than some overgrown "shelf" enclosures, but nowhere near the size and bulk of the big ones that married couples argue about!

It is a reflex system but the internally damped port is provided in the recessed base on which the enclosure rests. The arrangement contributes to the styling but it also make possible a port with a generous cross-section and low air velocity, venting at floor level—definite plus factors.

The composite bass drive is provided by two specially selected "Coral" 200mm woofers mounted on a sub-baffle, so that the rear of the front speaker does not protrude. The composite pair is rated to take 80W of program power and, since the sensitivity is fairly average for a hifi system, the sound output is substantial.

AWA stress that the rating is all the more significant because the system operates in a fundamental mode to below 30Hz without the need for bass boost. In fact, maximum output from the port, and therefore minimum cone travel occurs at 27Hz. Thus, very low organ notes which would tend to frequency double and "muddy up" the bottom end of conventional systems, tend to emerge as fundamentals from the port, with the cone itself exhibiting relatively small travel.

The bass drivers handle frequencies up to a nominal 500Hz, where a cross-over network diverts the output to a 175 x 125mm cone type mid range driver. The stated reason for choosing this type of speaker, for the prototype system at least, is that an oval cone tends to exhibit less concentrated Bell tones because of its distributed dimensions.

A 1-inch dome tweeter is used for the upper frequencies, taking over above 5kHz.

Removal of the front fret reveals the respective drivers and a recessed panel carrying level switches for the mid-range and tweeter. A calibration curve suggests a response within a 4dB window from 27Hz to 20kHz. Rated impedance is shown as 4 ohms.

Questioned about the linear phase concept, currently the subject of much attention, Wal Barlow expressed the conviction that phase was a pointer to other things in electrical circuits but it tended rapidly to become a random thing in free space. Therefore, while making no effort to stagger the frontal alignment of the drivers, he had paid very close attention to the divider network, trimming the various legs to provide the kind of signal required by each of the drivers.

When we first heard the system in action at the Sydney Consumer Electronics Show, two things were evident: first, the bass response was quite startling in its profundity, as distinct from its "thump" power; second the program material selected to demonstrate the unique quality was untypical of what most people listen to most of the time.

We were therefore most interested to have the opportunity to set the speakers up in our own building, in a fairly generous listening area, and to play typical program material through them from the Nakamichi System One, reviewed in our current Year Book. By way of comparison, we had a Philips Elcoma System 14 in a pair of George Hawthorn concrete enclosures.

On the first few tracks, picked more or less randomly, there appeared to be little difference in the bass end; both systems were good, both were adequate and the overall impression was that AWA had merely come up with another way of achieving a similar end result.

But then we dug out the theme music from the film "Earthquake", containing a segment of very high amplitude, very low frequency earthquake noise, allegedly going down to under 20Hz. That's when the difference showed up. But is it logical to create a special speaker system to hear "Earthquake" music outside a theatre?

But thus alerted, we listened further to still other material and the point had to be conceded: just occasionally, when the program reached down below 40Hz, the A-B tests would show up the extra half-octave from the port as discernible extra weight, way down.

Worthwhile? Worth whatever margin of cost might be involved?

There's no simple answer to that but it's what the purist approach is all about: the effort to ensure that the system will meet particular demands, even if they occur only rarely!

In the middle register, we felt that the DD88M was just a little too "forward" for all round listening—arresting in its projection of solo voice and instrument, but with a trifle too much coming from the one place in massed tones, as from full organ, full orchestra, full choir, &c. There was a level adjustment for the mid-range and tweeter speakers but we felt that the range of adjustment could have been increased to advantage. Wal Barlow was inclined to agree and it is likely that the final model will be so modified.

So there it is—another original and unique contribution to reflex loudspeaker system design by an Australian engineer, and one that is sure to grab the attention of his overseas counterparts.

When will the DD88M be available commercially and for how much?

We expect within the early part of the new year, and at a price level that will be up-market but significantly below the exotic imports. At the time of writing, we doubt that anyone could say more than that—not even AWA!

MICROPHONES

Part 3: Frequency response, directivity etc.

This series of articles is reproduced by courtesy of Sennheiser Electronics and is intended to assist sub-professionals and amateurs who need to use microphones, but without the advantage of formal acoustic training. This section deals with the frequency response and directional characteristics of practical microphones.

by G. PRAETZEL and E. F. WARNKE*

FREQUENCY RESPONSE: The frequency response (or bandwidth) of a microphone is shown in manufacturers' publications, mostly in graphical form. As an example Fig. 7 represents a frequency range from 30Hz to 17000Hz.

In Fig. 7 the frequencies from the lower to the upper threshold of audibility are plotted horizontally, while vertically the output voltage of the microphone in the "Decibel Scale" is shown. The following should be said about this dB scale.

A decibel is not an absolute measure like the metre, gram or Hertz. The dB signifies a ratio of two numerical values. Referring to the logarithmic perception of loudness of the human ear, the decibel was derived from the Brigg's logarithm of a voltage ratio:

$$20 \log U_1/U_2$$

or, correspondingly of a power ratio

$$10 \log P_1/P_2$$

If these formulas present a problem, the most important decibel values can be obtained readily from the accompanying tables:

voltage ratio		power ratio		dB
1:	1.4	1:	2	3
1:	2	1:	4	6
1:	4	1:	16	12
1:	8	1:	64	18
1:	10	1:	100	20
1:	20	1:	400	26
1:	50	1:	2,500	34
1:	100	1:	10,000	40
1:	200	1:	40,000	46
1:	500	1:	250,000	54
1:	1,000	1:	1,000,000	60
1:	10,000	1:	100,000,000	80

By way of further assistance, it is possible to convert figures from the dB table as follows:

example:
26 dB voltage ratio

$$26 \text{ dB} = 20 \text{ dB} + 6 \text{ dB}$$

= (10 times) x (2 times) = 20 times

Decibels are used to show deviations of the frequency response from straight-lined curve, in order to match the loudness perception of the human ear.

Thus Fig. 7, as an example of a high quality dynamic directional microphone, shows at 5000Hz a lift of some 5dB above the practically flat frequency response between 100 and 1500Hz. However, practical experience with just this type of microphone indicates that such a lift is often considered desirable, providing a "brighter" recording.

Where this extra brightness is not desired—depending on the ideas of the sound engineer—Sennheiser has provided its leading dynamic microphone the MD 441, with switchable brightness. Experience has proved that this microphone, in the great majority of its applications, is used with the upper response boosted.

DIRECTIONAL CHARACTERISTICS: So far, we have assumed that a microphone—and also, with limitations, the human ear—receives the sound uniformly from all directions, ie, are omnidirectional. Their directional characteristic in one plane is thus a circle, while their spatial directional characteristic corresponds to a sphere (see Fig. 8). In practice omnidirectional microphones are to be preferred as reporter's microphones for close talking. In this role a particular advantage of the omnidirec-

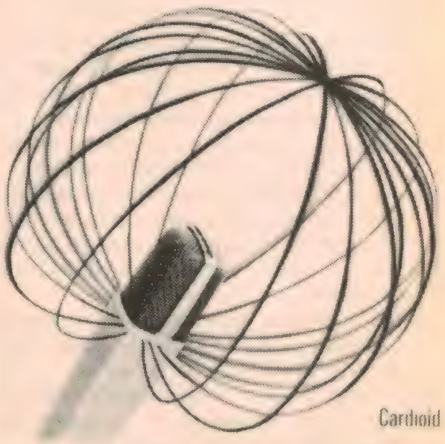
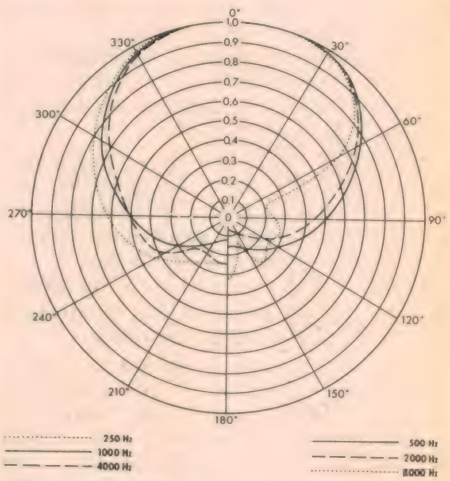


Fig. 9. Cardioid microphone directivity, spatially presented. Sensitivity is mainly to the front and sides.



The cardioid response in graph form, taken in a horizontal plane. Note how directivity varies with frequency.

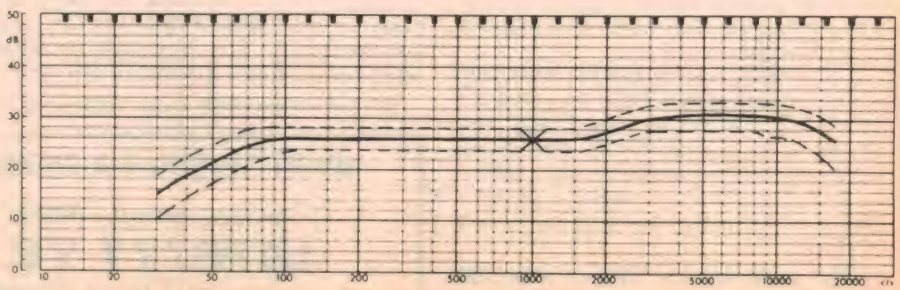


Fig. 7. This response curve of the Sennheiser MD 421 is typical of the kind of data supplied by manufacturers. The solid curve shows the nominal response and the dotted curves show the tolerance limits.

*Reproduced by arrangement with Sennheiser Electronic. Translated by T. M. Jaskolski and adapted for magazine publication by W. N. Williams.

tional microphone is its high insensitiveness to mechanical vibrations ie, handling noise.

The omnidirectional microphone is much less suited to recording distant sounds, since it also picks up extraneous noise and reverberation. For this job microphones with distinct directional characteristics are preferable. For a long time the classic cardioid microphone (Fig. 9) was considered ideal.

The cardioid directional characteristic effectively attenuates sound from the rear but is still sensitive to noise and reverberation from other directions. Better results in this respect are obtained with the super cardioid microphone, as illustrated in Fig 10. Even better, in really difficult situations, are those microphones with highly directional characteristics, as shown in Fig. 11.

In principle, however, all microphones with such directional characteristics are more sensitive to mechanical vibrations and handling noise, as well as to wind noise and to so-called "pop noises", ie,

Fig. 12. Anti-vibration sleeve for use with tripod stands or table stands.

air shocks caused by explosive sounds, than omnidirectional microphones. To overcome this the microphone manufacturers have to take special precautions. An effective remedy against wind interference is provided by "wind shields". These do not affect either the sensitivity or the frequency response of the microphone when suitable material is selected.

A special plastic foam is used for these shields. It should not be confused with conventional plastic foam as used for packaging, or filling for cushions, etc. Such material consists almost completely of closed pores which strongly attenuate sound at higher frequencies. The foam used for the wind shields is made by a special process in which the pores in the greater part of the material have been broken up, leaving only a skeleton foam. This has no effect on the frequency range concerned.

More expensive in manufacture but somewhat more effective are wind shields made of special silk. These shields are placed at a greater distance from the microphone's sound inlet and thus achieve a much greater effect.

Effective measures against sensitivity to mechanical vibrations are considerably more expensive. First, attention should be paid to keep vibration away from the microphone system proper. This can usually be achieved by spring suspension, either built into the tripod mounting for the microphone, (Fig. 12) or, in some microphones, into the housing itself (Fig. 13). Such procedures will usually reduce vibration problems to negligible proportions.

SIGNAL-TO-NOISE-RATIO: When a microphone is placed in a completely quiet room, connected to a high quality amplifier, free of noise and hum, it can

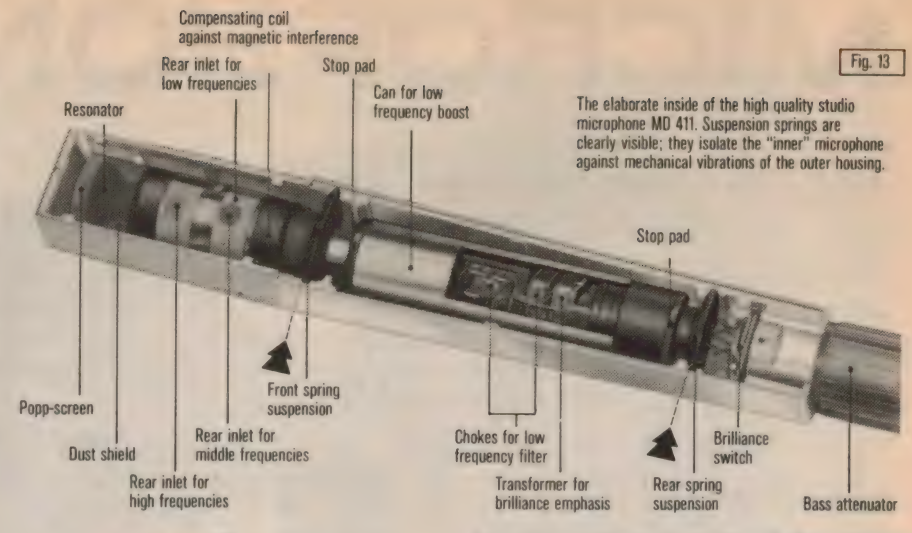


Fig. 13

The elaborate inside of the high quality studio microphone MD 411. Suspension springs are clearly visible; they isolate the "inner" microphone against mechanical vibrations of the outer housing.

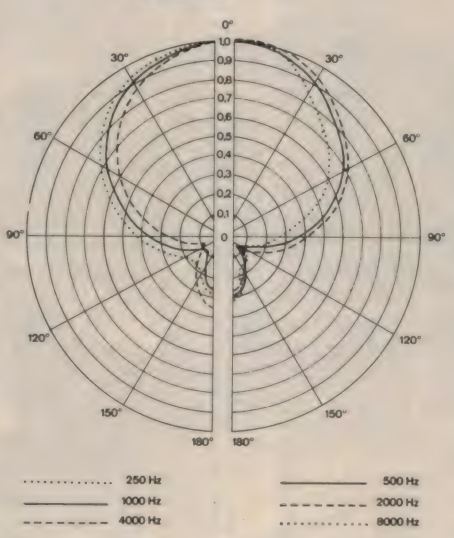


Fig. 10. The super cardioid response. Note the sharp nulls at 120°.

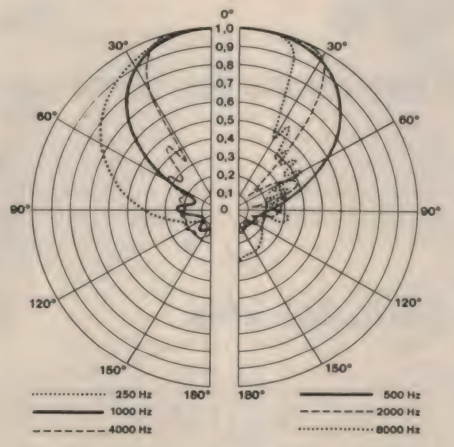


Fig. 11. Response curve of a highly directional (lobe) type microphone.

be shown that, in spite of the above precautions, the microphone still delivers a very low voltage which evidently has no connection with any external sound effects.

In all dynamic microphones with a moving coil of 200 ohms impedance this inherent microphone self-noise amounts to almost exactly 0.8μV. It is caused by a thermal electron movement in the copper wire of the moving coil and by the molecular movement of the air on the surface of the diaphragm.

Whether this noise voltage interferes with the recording depends on the one hand on the sensivity of the microphone and on the other hand on the volume of the sound to be recorded.

Let us assume, for instance, that we use a dynamic microphone with a sensitivity of only 0.1mV/μbar to record a speaker at a distance of one metre. We could thus reckon on a sound pressure of 1μbar. At this sound pressure the microphone would deliver a voltage of 0.1mV. Referring to the noise voltage of 0.8μV, we would have only a signal-to-noise ratio of 125 : 1 = 42dB! Should we, however, use a dynamic microphone with a sensitivity of 0.2mV/μbar, with other properties equivalent, the ratio of useful voltage to noise would be 250 : 1 = 48 dB.

The inherent self-noise of high quality studio capacitor microphones is, related to their sensitivity, about 7dB better so that, in recording conditions as described above, they could provide a signal-to-noise ratio of up to 56 dB.

Against this, the self-noise of some cheap electret capacitor microphones (again related to their sensitivity) is up to 10dB less favourable than that of the dynamic, so that their signal-to-noise ratio would be down to 38dB in the recording conditions described above.

Thus, where the input sound level is relatively high, and particularly where the dynamic range is small, the high internal noise of some microphones is of little consequence. But for low sound levels, and where there is a large dynamic range, only those microphones with the lowest internal noise will do.

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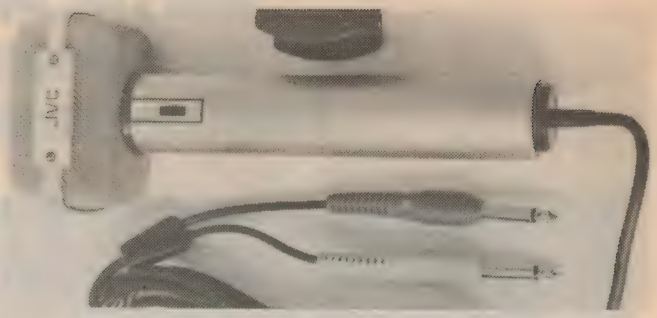
PA10L

New electret mics. & accessories from JVC

Over the past few years, the quality of microphones within the price reach of amateur recordists has improved tremendously, making possible recordings which do not sound all that different from the professional product. Typical of the new generation of microphones for the advanced enthusiast are two recently announced by JVC Nivico.



Above, the M-201 stereo electret microphone and, below, the components which make up the M-201 directional monosystem. Both come in a carrying case lined with moulded foam.

Designated as types M-201 and M510, both are electret capacitor types, with inbuilt battery-powered preamplifiers, producting an output impedance of 600 ohms.

The M-201 should be particularly attractive to those who like to take a stereo tape recorder along to organ society meetings and other such groups. It is a very attractively finished unit, with a mesh-enclosed head about 80mm wide containing two microphone capsules, each providing 120-degree cardioid directional pattern orientated about 45 degrees to either side of centre front. Together, the two capsules provide excellent stereo definition, while retaining good frontal sensitivity. Both are substantially protected by the housing from the worst effects of wind noise.

The barrel, or handle, about 30mm diameter and 160mm long, contains the preamplifier, a 1.5V cell for the power supply, an off-on music-speech switch, a switched –10dB pad to cope with overload situations, and the cable termination.

JVC quote the frequency response as 40-18,000Hz, the published curve looking commendably flat with only minor "squiggles" between +1 and –4dB from 100Hz up. Below 100Hz, the response drops another 2dB to –6dB at 25Hz. On the speech position, the response is cut by about 4dB at 100Hz and by up to 8dB at the very bottom end.

The sensitivity is quoted as –71dB (OdB = 1V/ubar) or –81dB with the attenuator and pad switched on. Signal/noise ratio is 47dB or better, wind noise 50dB SPL (music) or 41dB SPL (speech), and maximum input sound pressure level (pad on) 133dB.

Battery drain is 0.3mA or less, giving a battery life, with a high performance battery, of about 15,000 hours.

Attracted by the general appearance and finish of the M-201, we set it up in a home situation, plugged into a good quality cassette recorder. For a sound source, we used a pair of high quality loudspeakers, placed on either side of the mic. about 4ft away—not too close, but not so far away as to invite too obvious intrusion of room acoustics. Thus set up, we proceeded to record a mixture of orchestral, instrumental and organ, with natural voice announcements from left-centre-right.

Played back, the sound was the best we have yet heard under these conditions—a living room, domestic loudspeakers and a non-professional microphone. Apart from a slight room echo around 150Hz, the response sounded wide and clean, with the transients from acoustic guitar sounding particularly impressive. All told, the test held a strong promise that the M-201 would give an excellent account of itself in a live music situation.

Retail price of the M-201 is $42.00 including tax. It comes packed in compliant foam in a neat carrying case.

The M-510 is a more specialised multipurpose unit intended for advanced amateur through to semi-professional applications. A mono unit, it is really two microphones in one package—or at least it comprises a common amplifier/cable body, to which can be attached either of two heads, one giving a normal unidirectional cardioid pattern, the other a highly directional pattern. Windshields are provided, which can be slipped over either when the microphone is being used out of doors or under very close speaking conditions.

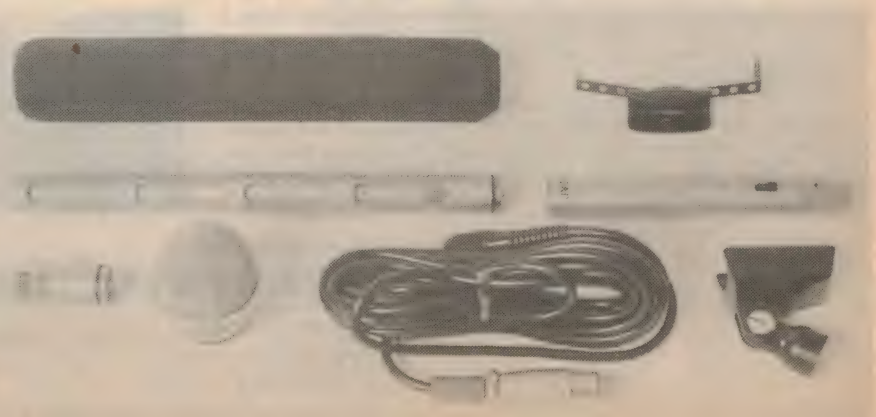
Because of lack of time, we did not have opportunity to test the M-510 in the same way as the M-201 but, from the literature, it would appear that the capsule and electronics are basically very similar. Thus, the shorter uni-directional capsule is credited with virtually the same frequency response and pickup pattern, marginally better signal/noise ratio and better rejection of wind and breath noises. In the "speech" position, the cut in bass response is about 2dB deeper. Sensitivity is the same.

For the super-directional capsule, the lobe is much narrower, the curves indicating a discrimination of at least 10dB front lobe over the 90-degree response, even across the low frequency range; above 300Hz, the ratio builds to an average of better than 15dB. Response below 2000Hz is virtually flat, with a slightly rising characteristic up to and beyond 10,000Hz. Sensitivity is quoted as –68dB for the frontal lobe.

Experience has shown that the M-510, in its super-directional mode, is very suitable for video taping activities where it is desired to keep the microphone out of the picture. Retail price of the M-510 is $139.95 including tax, and complete with carrying case.

JVC are also marketing a variety of accessories to go with their microphones, including a parabolic sound reflector, 6-channel mixer, extension cables, microphone stands and boom, spring suspension cradle, support for a stereo pair, &c.

For further information: Hagemeyer (A'Asia) B. V., 59 Anzac Parade, Kensington, NSW.



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LER 146

Luxor 9341 automatic turntable

Products produced in Europe often employ unconventional design concepts. So it is with the Luxor 9341, which is produced in Sweden. It provides fully automatic or manual operation and is most unusual in the method of providing these automatic functions.

The Luxor 9341 has a compact base and tinted cover with dimensions 407 x 150 x 345mm. An extra 65mm is required at the rear of the unit to allow the cover to open to the fully upright position. Hinges of the tinted cover are friction loaded to allow it to stay open in any position. The cover can also be completely removed from the base if desired.

A very compliant suspension is used to isolate the turntable chassis from heavy floor vibrations and from acoustic feedback. However, we feel that the suspension would be improved by the incorporation of damping. As it is, it tends to wobble around when the controls are operated. We also noted that the suspension had sagged a little at the rear, which may have been the result of rough transport.

The dynamically balanced arm has a decoupled counterweight and a sliding weight to set the stylus tracking force. The headshell is not removable. Instead, it has a slide-out plastic carrier which has 12.7mm mounting centres but no adjustment for stylus overhang.

Anti-skating force is applied by a spring mechanism operated by a calibrated dial. There are scales for conical and elliptical styli. The cartridge fitted to the arm was a Shure M75MB type 2. The instruction booklet does not state whether this cartridge uses a conical or elliptical stylus, so we used the lower anti-skating setting for conical stylus.

Surprisingly, the platter itself is a steel pressing. This has the advantage of giving a good flywheel effect but the disadvantage of interacting with the field of many magnetic cartridges to effectively increase the tracking weight.

Removing the steel platter reveals a machined aluminium sub-turntable which is driven by a small diameter idler. The idler, in turn, is belt-driven by a 12-pole synchronous motor. The idler is automatically engaged when the motor starts by a cog mechanism which is driven by the idler. This is a strange system and we wonder why Luxor did not opt for a simpler belt drive. This must presumably produce less rumble than the idler/cog mechanism.

Speed change from 33 to 45 rpm is accomplished by electrical rather than mechanical means. A two-core mains cord and three-pin plug was fitted, so earthing was via the signal cable braids. This is not recommended in Australia.

The most unusual feature of the Luxor turntable is the arm set-down and return mechanism. This is a spring mechanism which is loaded by the on/off/lift/lower control, which complements the disc size selector in setting the operating mode. Two disc sizes can be selected, 30cm and 17cm (corresponds to 12 and 7-inch sizes).

The arm can be made to leave the rest, position the stylus over the edge of the record and then gently lower. At the end of play, the arm returns to rest.

Since the lift/lower lever loads the spring mechanism, its action is very heavy when initiating the play cycle. For subsequent use of the cueing facility, the lever is light in action. As another sidelight, the arm mechanism can be disengaged by moving the disc size selector to M. This also disengages the arm trip sensor, but does not appear to effect a reduction in horizontal drag of the arm.

Wow and flutter of the Luxor 9341 is quoted at .05% according to DIN 45507 while rumble is rated at 62dB according to DIN 45539. We measured wow and flutter at about 0.15% which is a creditable result, but we were unable to obtain a particularly good result for rumble.

In operation, we found the arm mechanism sluggish and reluctant to work at all when 30 cm discs were selected. This latter fault appeared to be due to maladjustment of the height of the lowering device.

In other respects, the Luxor is satisfactory. It is physically quiet in operation and its suspension appears to work well in preventing acoustic feedback. The Shure cartridge performed well although we did not take measurements.

Recommended retail price of the Luxor 9341 turntable, complete with cartridge, is $248. Further information and demonstration can be obtained from the Australian distributors for Luxor products, O.B.C. (Imports) Pty Ltd, 1396 Malvern Road, Tooronga, Victoria. (L.D.S.)

Magnetic cartridges from National Panasonic

National Panasonic has released a range of four moving-magnet cartridges onto the Australian market. They are sold complete with headshell and storage holder, and every cartridge is accompanied by its individual frequency response graph.

Most magnetic cartridges, especially those in the higher price ranges, are supplied in a fancy presentation case which is about as useful as a spare groom at a wedding. Not so with National Panasonic, which has taken a different approach.

First, each cartridge is fitted into a standard headshell with the EIA locking collar, ready to use with the large majority of turntables. Second, the plastic box with its swing-out lid functions as a storage compartment for the headshell-cum-cartridge. This is a really useful idea since many keen enthusiasts have several cartridges mounted in headshells but no proper way of storing them safely.

The headshell storage compartment has space in the rear to store the supplied accessories—extra hardware, screwdriver and a small phial of stylus cleaning fluid.

There is one problem with the supplied headshell, however. It is the same as that fitted to Technics turntables and has no adjustment for stylus overhang. A small change to the headshell would make this possible.

Another refinement would be to fit the cartridges with flip-down stylus guards, rather than use the clip-on types supplied. Clip-on stylus guards are too easily lost, and can cause stylus damage when they are being removed.

There are two basic cartridges, the EPC-205 series which has three variants and the lower-priced EPC-270C-II. All have 12.7mm mounting centres, colour-coded terminals and removable stylus assemblies.

The three variants are the EPC-205C-IIS, EPC-205C-IIL and EPC-205C-IIH, The "S" is the standard model of the series with an output of 0.7mV/cm/sec. The "L" type is a low impedance version which has the advantage of not being affected by load impedance variations or high values of shunt capacitance. The compromise is a lower output voltage of 0.4mV/cm/sec.

The "H" version has the same impedance characteristic as the "S" version but a different stylus assembly which enables double the output voltage to be obtained, 1.4mV/cm/sec. The stylus assemblies of these two variants are interchangeable. The styli are elliptical, 0.2 x 0.7mil.

Apart from impedance characteristics, performance specifications for the EPC-205 series are identical. Frequency response is rated within ±2dB from 10Hz to 25kHz. Best results for the "S" and "H" versions are obtained with a load impedance of 50k and a cable capacitance of 100pF.

Tracking force for the trio is 1.25g ±0.25g. Channel separation at 1kHz is quoted at 25dB or more and 20dB or more at 10kHz.

tracked the +15dB test track on CBS STR 110 and the +12dB drum test track on W&G 25/2434. Separation at 1kHz is a little over 20dB ranging to a minimum of about 12dB at 12kHz.

The lower priced model 270C-II was also flat within ±2dB from 20Hz to 20kHz. The waveform showed some irregularities in the 8kHz region, while the square wave response showed some well damped ringing. Tracking performance was slightly better than for the 205C series but the higher tracking force should be taken into account. Separation between channels was excellent, with better than 40dB at 1kHz and better than 30dB over most of the range.,

Each cartridge is fitted in a headshell and supplied with a storage container.

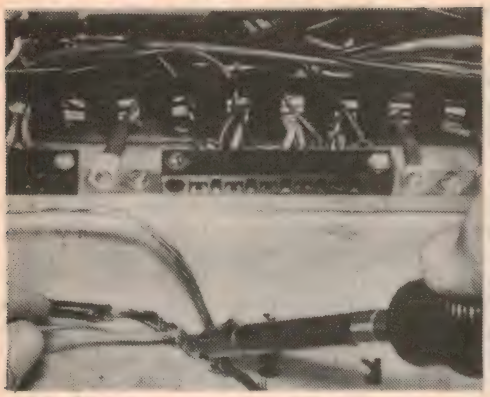
Specifications for the lower-priced model EPC-270C-II are as follows: Frequency response from 20Hz to 15kHz within ±2dB; channel separation 25dB or more at 1kHz; tracking force 1.75g ±0.25g. The stylus is elliptical, 0.3 x 0.7mil.

Our tests revealed that the performances were strikingly identical. This indicates tight quality control. Frequency response was within ±2dB over the range 20Hz to 20kHz as tested on the CBS STR-100 disc. Waveform on sine-waves was generally good, while square wave response was very good with little trace of overshoot or ringing. All three

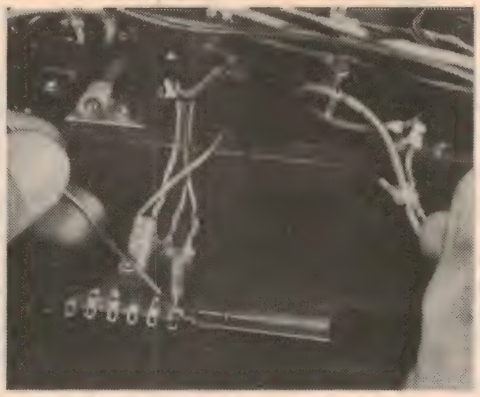
Clearly, all four cartridges are fine performers. The 205C series allow a number of useful compromises. For most amplifiers which have plenty of input overload margin, the "H" version would give a useful improvement in signal-to-noise ratio. The 270C-II model will appeal to those on a budget.

Recommended retail prices for each of the EPC-205C series is $67.50 while the EPC-270C-II retails for $35. Further information can be obtained from high fidelity retailers or from the Australian distributors for National Panasonic, Haco Distributing Agencies Pty Ltd, 57-69 Anzac Parade, Kensington, NSW. (L.D.S.)

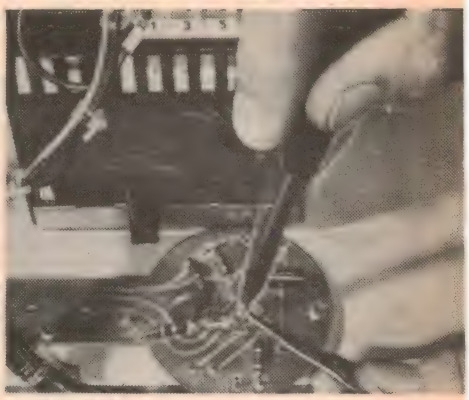
"WITHOUT MY SCOPE IRONS I RECKON I'D NEED A 25 HR. DAY."



8.00am "Start the day with a heavy earth connection on the emergency power plant. Need a 130 watt iron. My Superspeed's got that and more. Just as well, the workshop's 400 yards away".

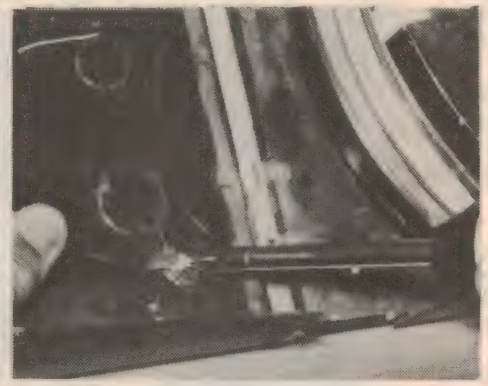


9.15am "Call from No. 2 Moulding Shop. Ran some temporary leads involving both tag joints and Printed Circuit Board (P.C.B.) connections. The Scope Minispeed handled the lot".

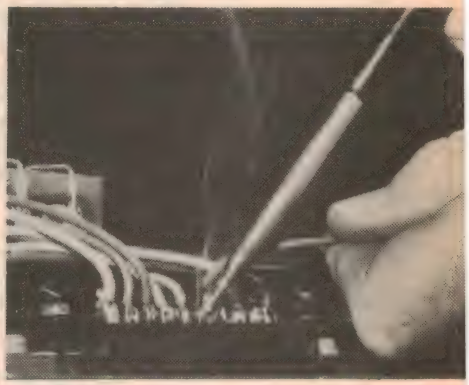


10.55am The V.D.U. in the process control room is playing up. Replacing miniature resistors on a P.C.B. is, ideally, the job for a temperature controlled 60w iron but my Scope Minispeed did the job and did it well.

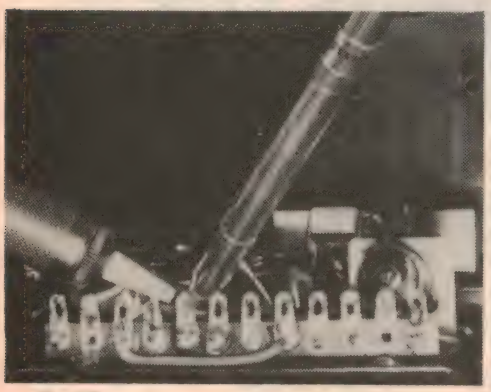
11.15am "Fix the speaker leads in the canteen P.A. Need a 30-40 watt iron, but my Scope Minispeed did the job".



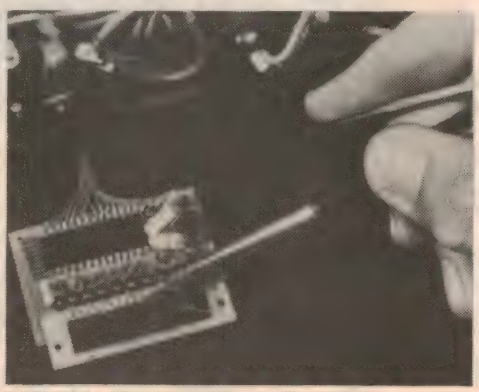
1.30pm "Resolder a 7/036 earth to sheet metal — LP gas flame would work, but too much risk of heat damage to PVC cable. The Superspeed iron produced its full 150 watts and did the job".



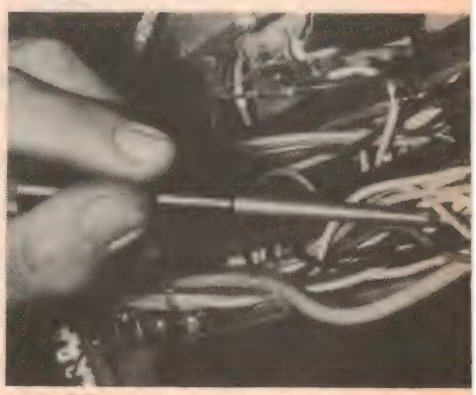
2.15pm "Fred borrowed my Minispeed to tackle an open circuit on the fork lift's headlights. He permanently soldered the wires to the terminal block, and used the Mini's 75 watts to do it".



2.17pm "Tag soldering in the workshop and a desolder job on a P.C.B. Using the Minispeed saves swopping between conventional 60 watt and 25 watt irons".



3.58pm "Emergency in shop six. I used my Minispeed to unsweat the leads of the main heater control circuit and then desolder the pyrometer circuit on the P.C.B. One iron, two different jobs".



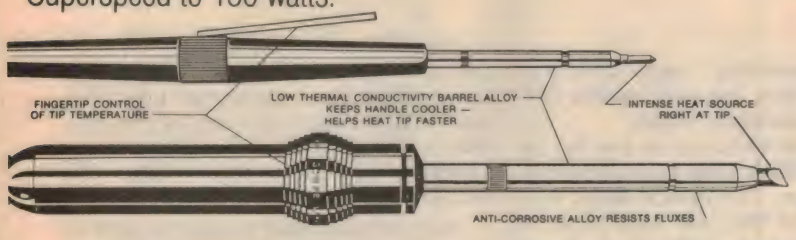
4.18pm "This wiring's a real birds nest. Passed through the wires with the Minispeed stone cold, desoldered the three joints, let the iron cool down, then withdrew through the PVC insulation. The 5 second heat up and low tip mass let's me do this".

Scope soldering irons save time three important ways:

1. Versatility.

One Scope iron replaces several conventional irons because it can tackle a wide range of soldering problems, from integrated circuits and printed circuit boards to heavy earth and chassis connections.

You don't have to swap irons half-way through the job. Both the Minispeed and the Superspeed function as 20-30 watt irons, and then within seconds and a touch of the finger switch, you get increased heat output to increase the Minispeed to 75 watts, and the Superspeed to 150 watts.



2. Speed.

Five seconds gets both irons ready for work, and they cool down quickly as well. When you encounter a heat sink you want an iron that can make up the heat loss instantly and maintain good soldering temperature. Result, the job's done fast and you can move onto the next.

3. Safety.

Scope irons are isolated from the mains. The special isolation transformer lets you work on live equipment with a higher degree of safety than a conventional iron.

The Scope range of products is designed to deliver efficiency and convenience. Consider the advantages of these products.

(A) Scope Cordless. 60W.

Designed for working where no power is available or during temporary failure. It's powered by two rechargeable Nicad cells with the capacity to solder between 100 and 200 typical electronic connections before overnight recharging.

(B) Scope 12V Hobby Iron.

This versatile iron is designed to work within 6 metres of your car battery.

(C) Scope Vibroscope.

This electric pencil allows for permanent writing on all metals. Valuable in an engineering store identifying metal tools, dating and naming parts, inscribing trophies.

For enquiries and further information on the Scope range of products contact: Scope Laboratories, 93 Matthews Avenue, Airport West, Melbourne, 3042.

SCOPE

THE RIGHT IRON FOR THE RIGHT JOB.

SL1

Light beam communications in the 1980s

The optical fibre revolution—Part 1

Communications via light beams and glass fibres—the concept sounds like science fiction to most people. But optical fibre communications are poised to become reality, and will revolutionise communications by the end of the century. The promise is a communications network made up of hair-fine glass fibres glowing with laser light, each capable of simultaneously carrying 20 channels of colour TV or 10,000 telephone conversations.

by JON FREDRIC

The familiar image of the soprano whose high notes broke a glass is about to reverse itself. Miles and miles of glass soon may be the major ingredient in breaking the world's communications logjam.

Within the next five years, modern technology hopes to begin solving many of the world's communications problems by using revolutionary new transmission media—light and glass—to achieve a viable system of optical communications. Glass tubes, lasers, integrated optics, lenses and prisms—items more appropriate to chemists, physicists and optometrists—soon will replace parts of the familiar network of copper cable and electronic circuitry that plays such a vital role in communications today.

Optical communications can be as much as 1,000 times faster than electronic communications. The optical fibres that are the basis for this new type of communication can hold 10,000 times more information than a like amount of copper wire or cable.

A revolution is now under way, triggered by significant breakthroughs in these non-conventional communications techniques, and by the mounting tie-ups and congestion that have almost crippled the conventional communications networks in the United States. The congestion results from overcrowded telephone lines that transmit all kinds of information, ranging from conversations to the transmission of pictures, and the exchange of data by computers.

One oversimplified solution would be to add more telephone lines. But this runs foul of space limitations—particularly in cities where conduits in buildings and under the streets are already overcrowded. There just isn't that much room for more lines.

The only realistic solution, then, is a communications system carrying a considerably greater number of messages within a smaller amount of space.

Sound impossible? Not any more!

Scientists have long known that light offers the fastest potential means of communication and has thousands of times the capacity of wire cables or even short-wave radio.

As early as 1870, the famous British physicist John Tyndall demonstrated the potential of light to the members of the Royal Society of England. He showed that part of the light illuminating the inside of a container of water was guided along a stream of the liquid flowing through a hole in the vessel's side. That was the first recorded demonstration of light transmission along a dielectric guide by total internal reflection.

In recent decades, the development of the laser provided the largest single boost to man's dream of communicating on a beam of light. However, researchers soon learned that sending "naked" laser beams through space wouldn't solve mass communications problems. The wavelengths used by these light beams

Corning research scientist Dr Frank Thiel demonstrates the practical use of optical fibre waveguides. Here a camera video signal is carried by an 1,100 ft long bundle of glass fibres coupled to a TV receiver.

are so short that atmospheric particles caused the signals to break up.

To solve this problem, researchers looked for ways to "pipe" the light beams from transmitter to receiver.

It wasn't until the 1950s that the idea of a hair-thin cylindrical core of glass—a pipe that carries light beams—evolved, according to Tingye Li and Enrique Marcatili of Bell Telephone Laboratories, American Telephone and Telegraph's AT & T) research arm.

At the same time, Bell Labs developed a way to make these fibres by pulling a preformed glass rod through an opaque tube that had been softened by heat in an oven. The rod forms the core and the tube forms the cladding that prevents light from escaping the "pipe".

Soon these fibres were being grouped in "coherent bundles"—flexible bundles that transmit high-resolution images. "From this point," say Marcatili and Li, "the number of inventions based on fibre optics mushroomed: faceplates for TV camera tubes, medical instruments, image dissectors for high-speed photography, and many more."

International Telephone and Telegraph (ITT) scientists in England were the first to explore fibre optics technology for long-distance communications. In the mid-1950s, a team headed by Dr Charles Kao, a native of mainland China, recognized that a technique employing pure glass and long-lived lasers could be developed to permit long-distance communications. The team subsequently began experiments.

According to Dr Kao, the scientists demonstrated an optical fibre system that could simultaneously carry 1,400 voice conversations, or 17 picturephone conversations. Eventually they were able to transmit full-colour TV pictures over the hair-fine fibre with excellent results. Today Dr Kao works for the ITT Fiber Optics Laboratory in Roanoke, Virginia.

The most promising light pipe was the fibre optic waveguide, which operates on the principle of total internal reflection of light. Each light pipe has a centre strand of glass surrounded by an outer glass cladding, which prevents light in the centre strand from escaping. Light entering the core glass and striking the outside cladding is reflected within the inner core repeatedly through the entire length of the fibre.

Early studies showed that, in order to be economically practical, waveguides (as these light pipes are now called) would have to transmit light signals with very low light loss. This loss of light in transit is expressed in decibels per kilometre, an expression of the ratio of the energy input to the energy output.

"From the start," says W. Bart Bielawski, of Corning Glass Works, "loss levels of 20dB/km were accepted by scientists in the field as the goal to be achieved," since that level meets the standards of today's telecommunications systems. It was also considered sufficient to tip the economic scales in favour of optical waveguides.

"That goal was surpassed in August 1972, when Corning achieved losses of as low as 4dB/km," he said. "But in June 1973, Corning reached the ultimate goal of 2dB/km," which finally made glass fibres economically attractive for use in long-distance communications.

Today there are two types of low-loss optical waveguides. The first-invented, better understood, and more glamorous is the single-mode waveguide. It has a tiny glass core that transmits light from a laser.

Its principal advantage is that it provides the highest capacity which gives it most promise for long-distance intercity communications. But its principal disadvantage is that the laser that must be used with it has yet to be perfected.

The other type, called "multimode," has a large optical-glass core that can carry types of conventional light. Because it is simpler to put together, it is expected to find more immediate use in shorter-range inner-city networks.

An optical glass fibre cable developed by ITT (centre) contrasted with conventional copper cables. The six-fibre glass cable has more communications-carrying capacity than the two larger cables combined.

Dr Charles Kao, the ITT scientist who first suggested using glass fibres for long-distance communications.

The main advantage here is that power requirements for the light sources are significantly less than those required for laser-based systems. In fact, the light sources for multimode fibres can be powered from the same supply used to power any associated electronic circuitry.

How does optical communication work?

In a recent telephone demonstration of optical communications by AT & T, the sound waves entering a telephone microphone were converted into electrical signals. These signals were then passed through an encoder, which converted them into electrical pulses that switched the light beam on and off, interrupting the beam being sent through to the end of the fibre tube. The signal is thus transmitted along the fibre as a series of light pulses, rather like Morse code dots and dashes.

At the end of the fibre tube, the light pulses were fed into a receiver and thence to a decoder for translation back into an electrical signal. This signal was used to drive the receiver diaphragm to reproduce the original sound waves.

So the process is practical and works quite well, but there are still problems to overcome before the system can be made available to the nation's consumers. Much work must be done to develop light sources and intermediate circuit parts that can connect the glass tubes and amplify the signals they carry.

The development of lasers sired the realization that optical communications might be feasible. It's ironic that further laser development has fallen behind the development of glass fibres, which experienced several major breakthroughs within recent years.

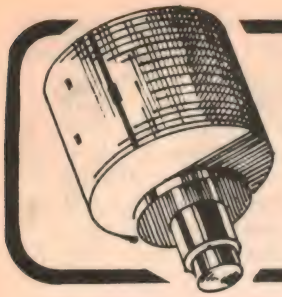
Nevertheless, researchers at many leading laboratories—notably Bell Laboratories (AT & T's research arm), International Telephone and Telegraph Corporation, and Corning Glass Works—are concentrating their efforts on developing the laser as a prime light source for optical communication.

Lasers provide absolutely pure beams of light that are ideally suited for optical communications. The combination of laser light and optical waveguides holds the greatest promise in terms of communications capacity.

Dozens of different lasers have been developed for other uses, and Bell Labs and others have devised new, smaller lasers at suitable frequencies. Yet none yet have the long life and reliability required for a communications system.

But the appearance of glass fibres that can carry laser light long distances is now spurring development. It's only a matter of time before the laser catches up.

(To be continued)



News Highlights

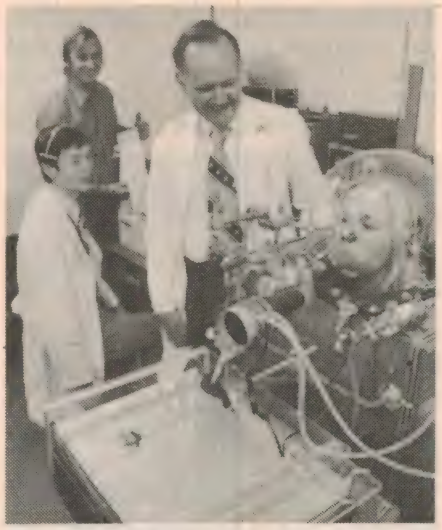
On-line computer analyses lung behaviour

A research group in the University of New South Wales School of Medicine has developed a unique system of "on-line" study of the mechanical behaviour of the lungs. This is believed to be the first such system fully operational in the world.

Working at Prince Henry Hospital, Associate Professor John (H.J.H.) Colebatch has successfully linked patients and a small computer to provide vital data on the patients' lungs which reflect their internal structure. The new system reduces the data almost instantly into graphs which are proving highly valuable in diagnosis, treatment and research on respiratory ailments.

Previous manual systems were so slow that a week could elapse before the results of tests on a patient could be finally analysed, rendering the system impractical for clinical situations.

There are two main aspects of the mechanical behaviour of the lungs—elastic behaviour which reflects the



properties of lung tissue, and conductive behaviour which reflects the number, size and distensibility of the airways. By making measurements that reflect the elastic and conductive properties separately it is possible to distinguish between, for instance, emphysema (tissue breakdown) and bronchial diseases, even when the distinction is not possible on routine clinical and X-ray examination. Such a distinction is important because it influences treatment.

The medical value of the new system is now being realised on a routine basis at Prince Henry Hospital, one of the University's teaching hospitals. The structural changes in diseased lungs can now be deduced from tests taking about an hour. Previously, doctors could only obtain such detailed information too late—through autopsies after death!

In addition to organising regular clinical applications of the system, Professor Colebatch is engaged in a study of the effects of ageing on the lungs. His group has already examined more than 80 healthy subjects, some of whom were provided by the Royal Australian Navy.

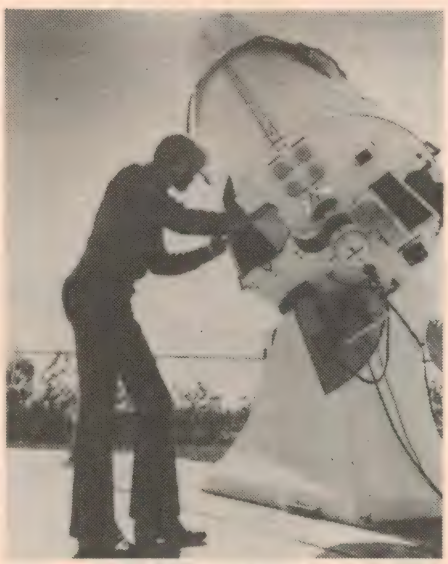
Solar observations may aid weather predictions

A newly developed sunlight filter is allowing astronomers at Lockheed's Research Laboratory in Palo Alto, California, to more accurately study the Sun in hopes of some day predicting the effects of solar flares, sunspots, and prominences on Earth weather.

The filter was designed and built by Lockheed and recently was selected by Industrial Research magazine as one of the 100 most significant new technical products of 1976. By excluding bright ordinary sunlight, the filter allows the detection of solar activity that is normally too faint to observe. The filter is tunable and can separate wavelengths that differ in length by less than one-billionth of an inch.

Although it is still too early to make any specific weather predictions from these solar phenomena, Dr Alan Title, senior member of Lockheed's Solar Observatory, says there is mounting evidence that short-term and long-term weather trends have a definite correlation with unusual solar activity.

Current research is aimed at under-



standing the nature of the sunspots, flares, and prominences—how they are formed; why they are formed; and how their effects are transmitted from the Sun. Once these questions are answered and understood, data from the occurrences can be used in the generation of large-scale weather prediction models.

Postgraduate course in digital control

The Footscray Institute of Technology has announced the introduction of a Postgraduate Diploma course in Digital Control. The course, commencing February 1977, covers two years part-time.

The course has been designed to cater for the increasing needs of industry for engineers capable of applying the latest minicomputers, microprocessors and sub-systems to specific on-line control and data acquisition systems. Special emphasis will be placed on practical experience and actual industrial applications.

Entrance requirements are a degree in Electrical, Electronic or Communications Engineering. Persons with a diploma in the above fields or with alternative professional qualifications, and who have relevant professional experience, may also be considered for admission.

Further details from the Footscray Institute of Technology, Department of Electrical and Electronic Engineering, PO Box 64, Footscray, Victoria 3011. Telephone 689 3400.

Dick Smith opens two new stores

Dick Smith's new Brisbane store.

Dick Smith's new Melbourne store

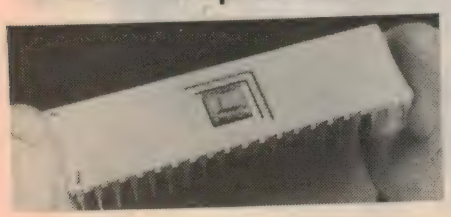
Dick Smith Electronics has opened two new stores; one each in Brisbane and Melbourne. The group now has five stores down the eastern coast of Australia, as well as many dealers appointed to handle Dick Smith merchandise right across the mainland and Tasmania.

The Brisbane store is in suburban Buranda, close to the Woolloongabba Cricket Ground. The address of the store is 166 Logan Road, Buranda. Logan road forms part of the Pacific Highway, the busy main road north out of the city, and puts the store in a prime location.

The Melbourne store is east of the city in the 'retail electronics centre', Richmond. This store is just a stone's throw from the Yarra River, and it too is in a prime location. The address is 656 Bridge Road, Richmond.

Both stores have department-store type layouts, with merchandise displayed in airy, well-lit sections. Both stores carry the same wide range as the 3 Sydney stores, a range which has made Dick Smith Electronics famous throughout Australia.

Ferranti develops fast 16-bit microprocessor



Ferranti UK has announced the release of the F100-L 16-bit microprocessor, the first microprocessor to be wholly designed, developed and manufactured in Europe. The new device was sponsored by the UK Ministry of Defence.

Produced using the Ferranti CDI process, the F100-L chip features high performance. Typical instruction times are 3 to 4 microseconds. It can also handle up to 32,000 16-bit words of fast semiconductor or core memory, and has advanced real time interrupt facilities. Power dissipation is less than 375mW.

The F100-L is fully supported by development software and a library of application programs which assist the user in programming his own system. Programs are currently developed on "host" computers. However, further software will be released in 1977 to allow programs to be developed on the F100-L itself.

Japan unveils new broadcasting technologies

The Japan Broadcasting Corporation (NHK) recently threw open the doors of its Technical Research Laboratories to the public for its annual display of technical achievements. Among the crowd at the display, held last June, were: a 30-inch wide screen colour TV display with 1,125 scanning lines, a gas-discharge colour TV panel, and a television ghost suppression system employing a charge-coupled device (CCD).

A second television ghost suppressor was also on show, this employing two variable directionality receiving antennas and a simple adjustment process. The CCD method has not yet been practically applied, although its future looks promising.

Colour TV cameras on show demonstrated the rapid progress towards LSI, resulting in reduced camera size, reduced power consumption, and greater reliability. The results of studies on standardising camera and VTR colour tones by means of a microcomputer were also made available.

Award for Plessey timber stress grading machine

The Australian developed and manufactured Computermatic timber stress grading machine has earned another international award for its manufacturer, Plessey Australia.

The latest award—a diploma gained at the Australian Trade Display in Moscow—follows a gold medal for technical innovation won by the machine at the Leipzig Spring Fair earlier this year.

The machine, which provides an accurate, reliable and non-destructive means of sorting timber into strength grades, has gained widespread acceptance overseas, particularly in the United Kingdom and Sweden where mechanically graded timber is increasingly specified for housing construction.

To date 85 Computermatics have been manufactured by Plessey in Sydney and 68 of these been exported, including two for installation in Russian sawmills.

The Computermatic determines the strength of square edged timber by subjecting it to a known load and automatically measuring the degree of deflection. The load applied does not damage the timber, unlike so-called 'proof testing' which involves applying a load close to the breaking point of the timber.

Motorola announces the high-current low cost 35 A bridge

We don't think anybody will admit coming even close to the MDA 3500's high-current, low-cost 35 amp capability.

Like giving 10 extra amps current handling at the 25 amp price. Plus 100 extra amps surge-protection at the 25 amp price, and super-efficient, 70 watt power dissipation at the 25 amp price.

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PERTH—RESERVE ELECTRONICS	87-1026

NEWS HIGHLIGHTS

Foot-controlled vehicle for the disabled

A foot control for a car—using the same principle as Concorde's fly-by-wire electrical controls—is now on test in Britain. It will make it possible for a severely disabled driver to have complete control of the car using only one foot. Like Concorde, it has duplicated control circuits and a 'fail-safe' monitoring system.

This standard British Mini car is steered by a small joystick operated by the driver's left foot, which generates a signal to an electrically-controlled servo system controlling the steering, throttle or brake as required. The prototype has been developed by Britain's Transport and Road Research Laboratory for the University of Reading.

Two independent control channels are used, with a third monitoring channel so that in the event of a fault the vehicle can be brought to a safe stop using the remaining working channel. The standard handbrake has been replaced by a ratchet-action unit as used in heavy goods vehicles.

Trials are in progress on the test track of the technical reliability of the system. Further tests will include manoeuvring in traffic and use in normal operating conditions.

BBC seek £2m for traffic radio service

The successful trial operation of a new traffic information broadcasting system in Britain has resulted in an approach by the BBC to the Government for a £2 million grant. The BBC wants to set up a chain of 80 national stations, which would continuously broadcast traffic information and hopefully avoid the major traffic jams that have occurred in the past.

The system consists of a series of low-powered radio transmitters together with a small, low-cost receiver in each car. All stations would broadcast on the same frequency in the medium wave band, and would have a range of about 20 miles. The receiver, costing around the £7 mark would be wired into existing car radios in such a way that the broadcast message would cut into any program the driver might have chosen.

The receiver could also be wired to cut into the music program from a cassette player. However, the driver will be able to switch off the traffic broadcast channel if he so chooses.

GE to build super-battery—10kW-hr goal

A $2.5 million contract for developing a superbattery that could be used by electric utilities for bulk-energy storage has been awarded to the General Electric Research and Development Center by the US Electric Power Research Institute (EPRI).

The 32-month effort—the largest battery-research contract ever issued by EPRI, the research arm of the electric utility industry in the US—will complement a parallel GE energy-storage program launched several years ago.

The program's objective: to develop a rechargeable sodium-sulphur storage battery that potentially offers five times more storage capacity per pound than a standard lead-acid battery.

Under the EPRI contract, GE scientists will seek to develop and construct a sodium-sulphur unit about the size of a file drawer, with a storage capacity of about ten kilowatt-hours.

Proposals are that large storage units could be installed to take excess energy during periods of low power demand and permit the power authorities to run power stations at optimum level, thus saving fuel. During peak demand periods, this stored energy could be discharged into the system without the need for extra generating capacity.

The new work sponsored by EPRI is directed toward further increasing the lifetime of sodium-sulphur batteries by improving certain components, particularly the seals that secure the system. It will lead to the construction of a 100-kilowatt-hour battery module? Such a unit could be trucked to a distribution substation and become the basic building block of a utility battery system. GE also expects to install and test a 5MW system by 1981.

NEWS HIGHLIGHTS

Wind tunnel for "hands-on" flight training

A new type of wind tunnel, developed in Britain, enables trainees to 'fly' a model aircraft so that many of the important features of aircraft behaviour during flight can be accurately observed.

Unlike conventional wind tunnels, the Flight Demonstration Wind Tunnel incorporates a control column for adjusting the model aircraft's elevators, and a throttle control for regulating the air speed in the tunnel. By operating these two controls, the trainee can 'fly' the model—simulating acceleration along the runway for take-off, control during flight, and full landing procedure. It is also possible to stall the model to study the relationship between trim and speed.

The tunnel, however, is not limited to visual demonstrations. The linkage supporting the model is attached to instrumentation capable of measuring aircraft trim, altitude, the influence of the centre of gravity on stability, and lift force. The effects of airstream can also be measured using a smoke distributor which shows the flow pattern past the model in normal and stalled conditions.

AWA sells air navigation aid to Portugal

An Australian designed and manufactured radio beacon has been chosen for a new air navigation installation at Portugal's Lisbon airport.

The beacon, a product of the Avionic Systems Department of Amalgamated Wireless (Australasia) Ltd, is the main element in a contract awarded by the Portuguese Government to the Decca Navigator Company of Britain for the airport installation.

The beacon is a Doppler VOR (very high frequency omnirange) particularly suited to airports and enroute locations where radio signals are affected by reflections from mountains, buildings and other obstacles. VOR is an international standard medium range guidance system providing bearing information to aircraft.

AWA Doppler VOR beacons are already operating at Kathmandu and Pokhara in Nepal, at Biggin Hill near London, UK, and are being installed at Mersing in Malaysia, and at 10 locations in Australia.

Burroughs to build a "supercomputer"

US computer manufacturer Burroughs recently announced that it intends building a "supercomputer" to carry out the solving of problems at present considered too large for existing machines.

Basically, the machine will be an array processor; that is a series of smaller computers operating in parallel on a large problem divided into sections. It will be so powerful that it will need one of the company's largest conventional machines to prepare and feed it with information, and to collect the results.

Suggested applications are in meteorology, space studies and logistics, etc. The first machine is expected to be running by the end of 1978, and will be programmed in Fortran.

A similar machine is also under consideration in Britain by International Computer (ICL), which is awaiting government support before going ahead with the project. This machine, if built, could be anything up to 100 times faster than existing machines, according to the type of problem.

Cable TV—via optical glass fibres

Thirty-four thousand cable television subscribers in the Hastings area of England are believed to be the first in the world to watch TV programs brought to their receivers over strands of glass rather than wire.

According to a recent press release from Corning Glass Works (United States), Rediffusion Limited of London has been using a 1.427-kilometer length of optical cable, inserted into its existing network in place of metallic-conductor cable, since March 1976.

The cable was manufactured by BICC Telecommunication Cables Limited. It contains two hair-thin strands of glass made by Corning in the USA. Installation was carried out by Rediffusion engineers, and completed in just two days.

When you dance around the room can you hear all the music?

Some very heady stuff is bandied about when it comes to discussing the pro's and cons of various speakers.

All of it rather wonderful of course, but invariably there's one small catch.

Unless you stand practically right in front, the sound you get will never be all that clearly defined.

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Not only can you hear them in just about any part of the room, but you can hear, very clearly, every instrument that's meant to be heard. Simply because they give near hemispherical dispersion.

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While the concave air spring tweeter produces nearly hemispherical dispersion across most of the audible range.

The Epicure Tens also contain a rather unique low-mass woofer.

This gives a smoother, more accurate bass, enabling you to hear the individual bass instruments, and not just the bass.

In fact so proud are we of our speakers, we even go so far as to give them a ten year warranty.

And that's an awful lot of dancing around any room.

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SA's performance exceeds even CrO_2, which suffered from reduced output in the middle and low frequencies (SA provides 1.5-2db more output than the best CrO_2 in those ranges, equal output at high frequency).
SA also outperforms the ferric-oxide tapes (regular and cobalt-energized) which are unable to take full advantage of the noise reduction benefits of the CrO_2 equalization because their high-end saturation characteristics are not compatible with this standard.

Ask for TDK SA Cassettes.

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PF 648

Australia's first domestic cable TV system

Although cable TV systems are very much a part of the domestic TV scene in some overseas countries, notably Canada and US, such systems have been unheard of in Australia — up until now that is. By the time you read this, Australia's first domestic cable TV system should be in operation in a housing commission complex in Melbourne.

Scheduled to commence operations this September, Australia's first cable TV system is a joint project of the Melbourne City Council and the Victorian Housing Commission. It will serve about 4,000 tenants in the Debney's Park Housing Commission Complex, and will operate by cable from a studio set up at the Debney's Park community centre.

Debney's Park is a complex in the suburb of Flemington, on the fringe of the city, and contains a number of high-rise blocks. The closed circuit TV is seen as a means of combating the loneliness which sometimes afflicts people living in high-rise communities.

Cabling from the community centre to the Housing Commission flats was still in progress as this article was written, although some flats were to be connected for the opening in mid-September. It is expected that 10-hours of programs a week will be fed via the existing coaxial cable master antenna system.

The station will be run by the Debney's Park recreational control panel, comprising seven representatives from the Debney's Park community centre executive, the local primary school, the Housing Commission tenant's representative and the City Council Parks, Gardens and Recreation Department. Mr Gerry Quirk, the City Council's recreation officer, will be the station manager.

The system itself was designed by the engineer's department of the City Council, and uses two AWA Rediffusion closed-circuit TV carmeras – a studio camera, with rear control zoom lens and mounted on a tripod, and a hand-held camera which can either be used with an adaptor as a second studio camera or with a portable video tape recorder. The second camera also has a manual zoom lens.

On the technical side, the production director is able to view the outputs of the two cameras on two monitors. The outputs can be mixed through a video mixer to provide fades, corner inserts, wipes and other effects.

Output from the mixer is viewed on a third monitor, and can either be recorded on an electronic edit video tape recorder or fed through a modulator to the Debney's Park Housing Commission flat complex. The mixer is equipped with a function board which enables synchronisation between the portable video tape recorder and live camera outputs, enabling effects to be performed between these two inputs.

An AWA Rediffusion 12-inch monitor/receiver is used to enable monitoring of the output.

Two microphones are used for studio sound recording, together with an audio mixer. Two-way communication is available between both cameramen and the production director. The control desk is portable, enabling it to be transported to and from locations.

The aim is to train tenants in the use of the equipment, so that eventually they can run the station themselves. Programs will revolve around activities at the estate's community centre and will mainly concentrate on entertainment such as drama, singing and folk dancing.

The Debney's Park experiment may well be the beginning in Australia of a swing towards more community involvement in television and, in particular, towards cable TV. In Britain, for example, the use of cable systems has enabled at least five large towns to set up non-commercial community networks which may only concentrate on local people and local issues.

Regulations in both Britain and Australia prevent the commercial use of cable TV, but many other countries have no such restrictions. In Canada alone, it is estimated about one-third of the population receive TV programs via cable.

Cable television, in more advanced form, involves linking household television receivers to a broadband cable, which can carry far more channels than available through the crowded airwaves, gives interference-free reception, and can also be loaded with signals for other communication services. However, the future of cable TV is in limbo in Australia at present, still dependent on Government decision.

Community operators use AWA Rediffusion camera equipment to record children's activities. The aim is to provide 10 hours of programming per week.

Reprinted from "The Australian Financial Review".

CSIRO research aids industry . . .

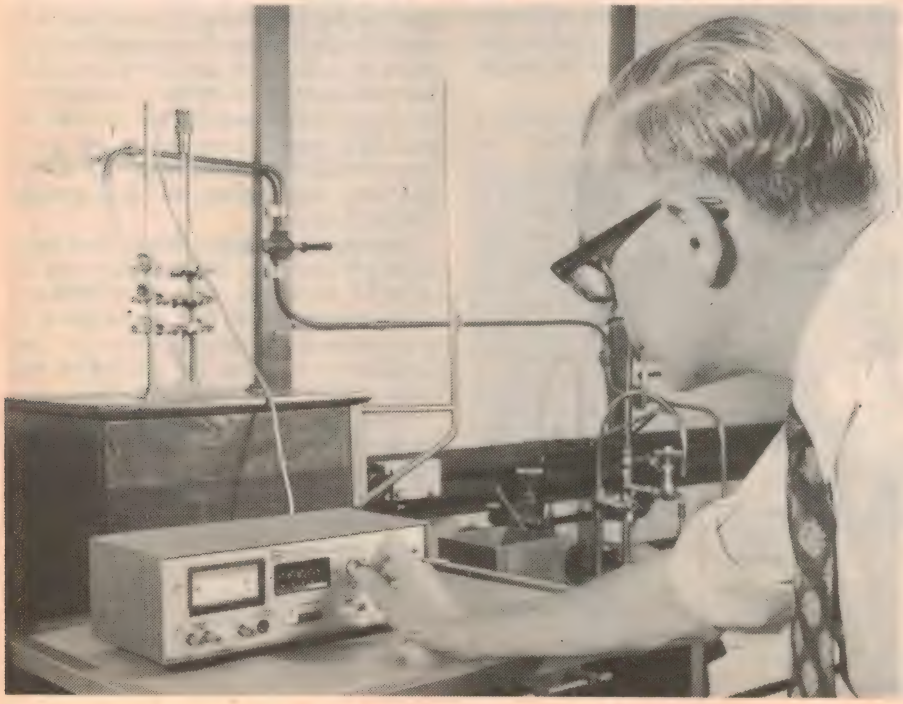
AC bridge circuit for temperature measurements

A new, inexpensive AC bridge for use with platinum resistance thermometers for accurate temperature measurement has been developed by the CSIRO National Measurement Laboratory, Sydney. The new bridge makes possible temperature measurements to better than .025°C over most of the range —250°C to +550°C, with suitable thermometers.

The platinum resistance thermometer has been used for many years for the most precise measurements of temperature. The resistance of pure platinum changes in a known and predictable way with changes in temperature and is highly reproducible. A platinum resistance thermometer usually consists of a resistor of very pure platinum wire mounted in a strain free condition and enclosed in a suitable sheath for protection.

However, in the past the measurement of resistance of such thermometers has usually been made with expensive precision DC bridges consisting of a multitude of precise resistors and high quality switches. Drifts in value of these resistors necessitates frequent and expensive calibrations. The use of a typical DC bridge is plagued by the presence of thermal EMFs which can make measurement difficult. AC techniques overcome the thermal EMF problem but the other drawbacks remain.

The new NML AC bridge uses a ratio transformer in which inherently stable and accurate ratios are maintained.



A commercial instrument based on the CSIRO's new bridge circuit has already been developed. The unit shown above is made by Leeds and Northrup Aust. Pty. Ltd.

Precise resistance measurements normally require some method of eliminating the errors due to the resistance of the leads connecting the resistor to the bridge. The high input impedance of typical ratio transformers permits simple bridges to be made which are relatively unaffected by reasonable values of the lead resistances, but these systems suffer from an extremely non-linear relationship between the resistance measured and the setting of the ratio transformer. The combination of modern integrated circuit operational amplifiers with ratio transformers enables bridge circuits to be constructed which overcome this problem.

The unit shown in the photograph is made by Leeds & Northrup Australia Pty Ltd, and is a commercial development of a system developed at NML specifically for platinum resistance thermometry using mainly elements of 100 ohms nominal resistance at the ice point. It has a range of 0 to 300 ohms and an accuracy of ±0.01 ohm.

The sensor current is 1mA at a frequency of 80Hz, and the errors introduced by a resistance of up to 10 ohms in any, or all, of the leads is negligible. Small currents must be used to avoid self heating of the thermometer.

The instrument comprises a sinusoidal oscillator which excites an "active bridge" network whose output is effectively zero in the balanced condition. The bridge output is measured by a null detector channel comprising a high gain AC amplifier, phase sensitive detector and DC amplifier stages.

The basic principle of the new bridge network is shown in Fig 1. The output of the oscillator, designated V, is applied to a controlled current source (CCS) and a linear voltage divider, ratio k, which represents the five measuring dials. The controlled current source (CCS) has the

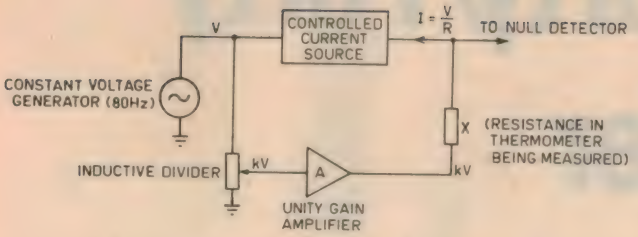


FIG.1 BASIC OPERATING PRINCIPLE OF BRIDGE

property that its output current I is proportional to input voltage (ie., I = (1/R).V where R is a transresistance) and is not affected by the actual voltage appearing at its output terminal due to a load impedance.

The current I flows through the unknown resistor X from the output of an unity gain buffer amplifier connected to the tapping point of the divider. Thus the voltage at the lower end of X is kV, and the voltage at its other end becomes zero when X = kR, which is the required balance condition.

The practical circuit, somewhat simplified, is shown in Fig 2. The CCS is formed by the integrated circuit operational amplifier A1 and the two pairs of equal resistances R and Z. The combination of positive and negative feedback gives the constant current characteristic.

The unknown resistance X is shown as a four terminal connection with lead resistances r, which are not required to be similar in value. Operational amplifier A2 is connected as a "voltage follower" with the negative feedback taken from the four terminal junction point Q. Thus the potential at Q is equal to kV. The null detector A3 is connected to the other junction P and the previous balance condition is unchanged by the effects of the lead resistances.

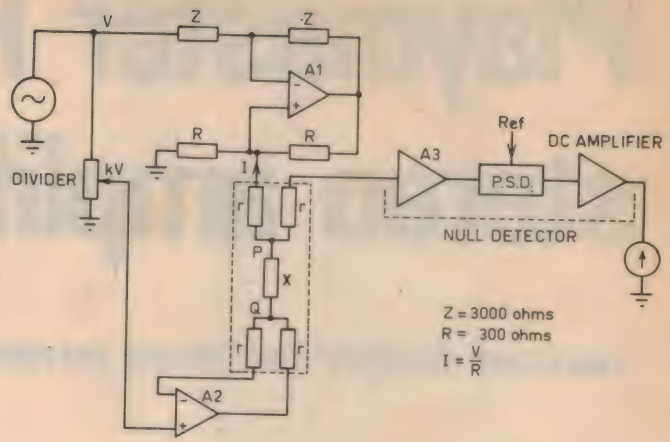


FIG.2 ARRANGEMENT OF COMPONENTS FORMING BRIDGE NETWORK

The quadrature error signal which is always present with AC bridges due to stray capacitance and inductance is relatively small due to the low operating frequency, and is rejected by the phase sensitive detector.

The accuracy of the bridge depends on the divider, which uses the ratio transformer technique for the three most significant dials. These ratios, which depend on tapped transformer windings, are inherently stable and unaffected by ambient temperature or long term drift. Simple resistive networks are adequately stable for the less significant dials.

The new bridge, which is available commercially for under $800, should give research laboratories and industry the capability of making accurate measurements inexpensively. It has the additional advantage of being easily portable for in-the-field measurements, and can operate either from batteries or from an integral power supply.

Playmaster Forty/Forty stereo amplifier

revised design has more power and even lower hum

We have had many requests for a higher powered version of the very popular Playmaster Twin Twenty Five stereo amplifier, so here it is. The new version offers more power and some other performance aspects have been improved. Constructors can easily upgrade their existing Twin Twenty Five to the new circuit, if they so desire.

by GREG SWAIN & LEO SIMPSON

Perhaps we should explain, at the outset, that we were not keen to produce a higher powered version of the Twin Twenty Five. Why meddle with a design which has proved to be very reliable and popular? Several thousand have now been built and there is no indication of a decline in sales.

However, ever since Applied Technology Pty Ltd of Hornsby, NSW, consulted with us regarding their own higher-powered version, there has been a constant stream of requests from readers and kit suppliers to indicate what is involved. If we were reluctant to do so, it was simply because an increase in power output from 25 watts to 40 watts is a barely audible 2dB. To obtain a worthwhile audible increase, the power ratio really needs to be about 6dB, ie, 4 times the power.

Ultimately, some incentive to proceed with the higher powered version was provided by Dick Smith Electronics Pty Ltd. They arranged for the supply of a higher rated C-core power transformer and thus overcame a number of practical objections we had. The new transformer fits into the existing chassis, so no alterations to the metalwork are required. More importantly, the new transformer has less external hum field.

In fact, the new transformer has less external field than the smaller transformer in the Twin Twenty five version. As a result the amplifier is physically quieter—the field is much less likely to cause the metal lid of the case to hum. Nor is there any sign of lamination buzz; this can be frustrating in an amplifier which is electrically very quiet.

A lower hum field also means that there is less likelihood of hum being induced into cassette decks or magnetic cartridges—a very common problem in hifi installations. We found that the new transformer gives a 6dB reduction in induced hum in typical magnetic cartridges and cassette decks, compared with the smaller transformer mentioned above.

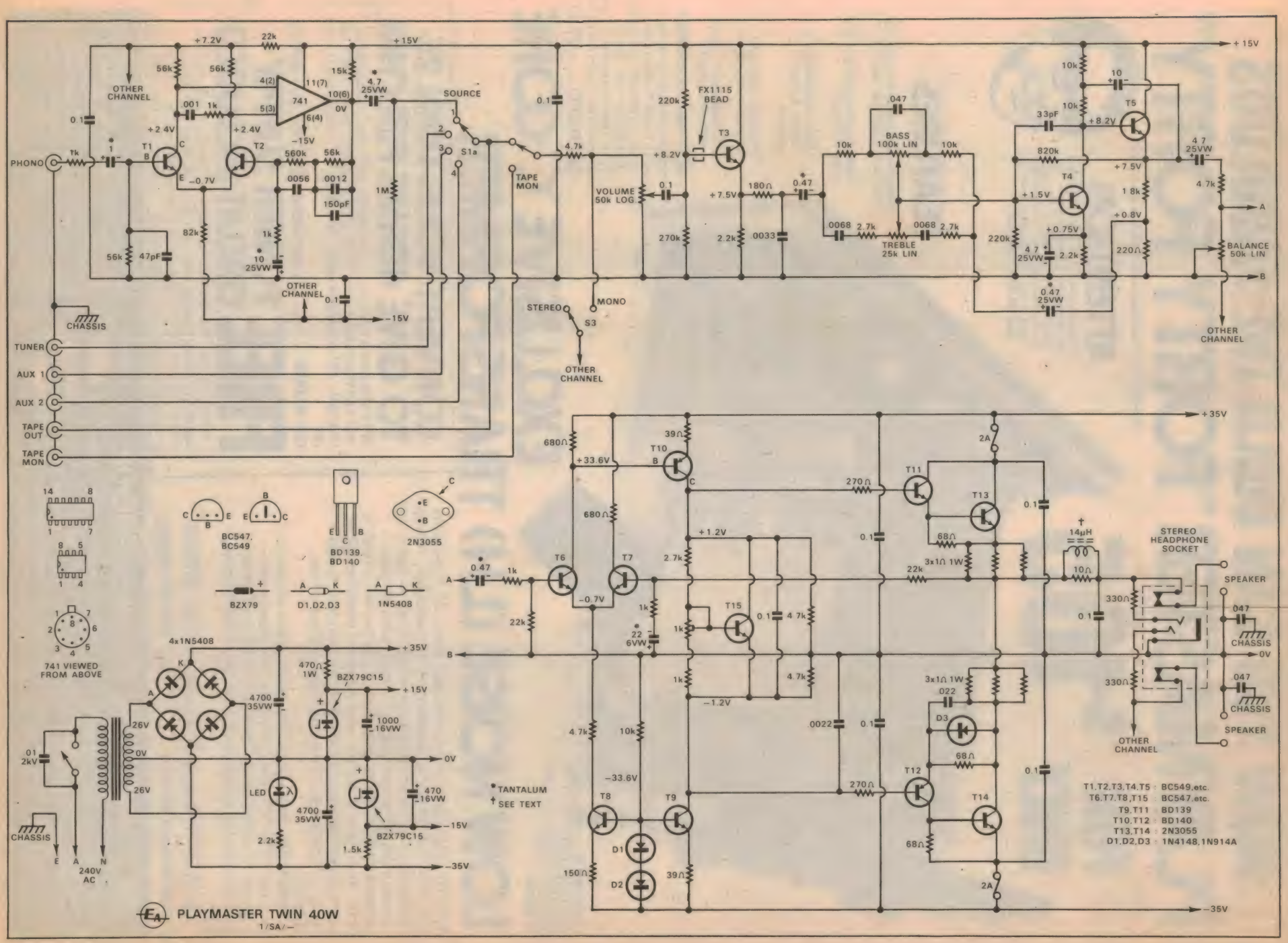
The C-core transformer is also more efficient and runs cooler.

So the new transformer has enabled us to improve the subjective performance as well as upgrading the specifications, adding up to a worthwhile all-round improvement.

Other changes to the amplifier are less noticeable. The class-A driver transistors, T10, T110 and the constant current source transistors, T9, T109 are now higher rated BD139's and BD140's. The thermal compensation transistors, T15 and T115, are now mounted on the rear panel, adjacent to the power transistors. Capacitors have been added to the inputs of the power amplifiers to render the output offset voltages independent of the Balance control setting.

The new circuit and wiring diagrams also incorporate a number of corrections which have been noted since the original articles were published. Readers constructing Twin Twenty Five versions from scratch may apply all the changes noted above.

Previous articles in April, May, June and September 1976 have discussed the amplifier circuit and performance in detail, so we will only give a brief resume of the circuit operation, beginning with the power amplifier.


+7.2V
22k
+15V
56k
56k
OTHER CHANNEL
4(2)
11(7)
15k
4.7 25VW
741
10(6)
5(3)
6(4)
0V
-15V
SOURCE
001
1k
0.1
+2.4V
+2.4V
T1
T2
PHONO
1k
560k
56k
0056
0012
150pF
1M
82k
56k
47pF
10 25VW
OTHER CHANNEL
0.1
-15V
CHASSIS
TUNER
AUX 1
AUX 2
TAPE OUT
TAPE MON
S1a
TAPE MON
0.1
4.7k
220k
FX1115 BEAD
+8.2V
T3
VOLUME 50k LOG
0.1
270k
+7.5V
180Ω
0.47
2.2k
.0033
STEREO
MONO
S3
OTHER CHANNEL
047
10k
BASS 100k LIN
10k
.0068
2.7k
TREBLE 25k LIN
.0068
2.7k
10k
33pF
10
T5
+8.2V
820k
T4
+1.5V
+7.5V
1.8k
+0.8V
+0.75V
4.7 25VW
2.2k
220k
220Ω
0.47 25VW
4.7 25VW
4.7k
A
BALANCE 50k LIN
B
OTHER CHANNEL
+15V
+35V
680Ω
39Ω
+33.6V
T10
680Ω
270Ω
T11
T13
0.1
0.1
68Ω
3x1Ω 1W
22k
+1.2V
2.7k
0.47
1k
T6
T7
-0.7V
22k
1k
22 6VW
T15
0.1
4.7k
1k
1k
4.7k
-1.2V
2A
†14μH
10Ω
STEREO HEADPHONE SOCKET
SPEAKER
330Ω
047
CHASSIS
0V
330Ω
047
CHASSIS
SPEAKER
OTHER CHANNEL
3x1Ω 1W
.022
D3
68Ω
T12
T14
68Ω
270Ω
0.1
0.1
.0022
4.7k
10k
-33.6V
T8
T9
D1
D2
150Ω
39Ω
2A
-35V
14
8
1
7
8
5
1
4
BC547, BC549
BD139, BD140
2N3055
BZX79
D1,D2,D3
1N5408
741 VIEWED FROM ABOVE
4x1N5408
+35V
470Ω 1W
BZX79C15
+15V
4700 35VW
1000 16VW
0V
.01 2kV
26V
0V
26V
LED
4700 35VW
470 16VW
2.2k
1.5k
BZX79C15
-15V
-35V
CHASSIS
E A N
240V AC
*TANTALUM
† SEE TEXT
T1,T2,T3,T4,T5 : BC549,etc.
T6,T7,T8,T15 : BC547,etc.
T9,T11 : BD139
T10,T12 : BD140
T13,T14 : 2N3055
D1,D2,D3 : 1N4148,1N914A
PLAYMASTER TWIN 40W
1/SA/-

NOW YOU CAN BUILD THE FABULOUS PLAYMASTER "FORTY FORTY"

Designed by Leo Simpson. See E.A Dec. 1976

FOR ONLY $105

PACKING & POSTAGE FOR PLAYMASTER FORTY–FORTY IS $5.00

ATTENTION

This playmaster Forty Forty has the low noise transformer. The Twin 40 is a cheaper Amp with a normal iron core transformer. We do not supply the Twin 40 and do not intend to.

FEATURES

- *Simplified complete instruction manual & assembly instructions
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OPTIONAL CABINET

Optional high quality simulated Teak timber cover, gives the Amplifier that $500 look. Suits both the Playmaster Twin 25 and the "Forty Forty".

Cat. H-3113 .. .. $7.50

EXCLUSIVE 'C' CORE LOW NOISE (LH) TRANSFORMER

The "C" core transformer in the Dick Smith kit is exclusive – and its one of the key components in this amplifier. Normal interleaved (laminated) transformers are alright – just – but for optimum performance the "C" core, with its grain – oriented steel and better electrical characteristics is hard to beat. The result: a quieter more powerful amplifier. More power can be delivered by transformer with less "noise" being radiated to get in the sensitive front end of the amplifier.

ATTENTION: This amplifier is slightly more expensive because of the "C" core (LH) low noise transformer – however it is really worth the extra $5.00 – on headphones alone the background noise level is noticeably lower.

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"C" Core Transformer only .. .. Cat. M-0148 $24.50

CONVERT YOUR TWIN 25 TO GIVE 40RMS PER CHNL.

With this conversion kit – complete with full instructions – you can now boost your Twin 25 to give 40 watts RMS per channel. All necessary parts including "C" core transformer etc.

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FREE POWER SUPPLY CIRCUIT INCLUDED

If you purchase the conversion kit we include a full circuit diagram to show how to use your existing Twin 25 Transformer for a 13.8 volt 2-4 Amp Regulated supply – ideal for bench use and CB Transceivers – a must for the hobbyist.

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Dealers prices may be higher due to transport costs."

T6 and T7 form a differential pair which enables the amplifier quiescent output voltage to be set close to 0V and thus eliminate output capacitors. Current through the differential pair is set by the constant current source T8 which uses D1 and D2 as its voltage reference. To ensure that the differential input stage remains balanced even at very high frequencies, T7 has a collector resistor of the same value as T6, ie, 680 ohms. This ensures that the voltage excursions at the collectors of T6 and T7 are always similar.

Constant current source T8 provides a high degree of hum rejection and also enables the differential input stage to maintain control over the output offset voltage, even when the balanced supply rails fall to a value of only a few volts (as happens after switch-off). The net result of this is that there is no delayed thump from the loudspeakers after switch-off.

Signal output from the differential input stage is taken from the collector of T6 and amplified by common emitter stage T10. Local feedback in this stage is in the form of emitter degeneration provided by the 39 ohm emitter resistor. No-signal current through T10 is set by constant current source T9 which also uses as its voltage reference, D1 and D2.

T10 would normally provide a very high source impedance for the following stages by dint of its constant current source load T9. This is undesirable for several reasons, so both sides of T15 are tied to the 0V line with 4.7k resistors. This makes the collector load of T10 about 2.3k and renders the voltage gain of this stage almost independent of the output stage loading.

A more important advantage of this arrangement is that it provides voltage drive to the output stages and thus enables them to achieve a much better bandwidth.

The output stages operate essentially as Darlington emitter followers with no voltage gain but considerable current gain.

T11 and T13 combine to form a conventional Darlington emitter follower, while T12 and T14 form a compound transistor also operating as an emitter follower. Diode D3 provides the same overall Vbe drop as the T11/T13 Darlington and thus helps to make the output stage more symmetrical. The .022uF capacitor across D3 compensates for the load capacitance in the collector circuit of T12 due to the Miller capacitance of the base-collector junction of T14. The capacitor thus gives another small improvement in output stage symmetry.

Voltage gain in the amplifier is set by the ratio of the 22k and 1k resistors in the base circuit of T7. Low frequency response is set by the 22uF feedback capacitor.

An RLC network at the output of each power amplifier ensures unconditional stability. This RLC circuit was developed by A. N. Thiele and published in Proc. IREE September 1975. As a bonus, the network prevents RF interference picked up by long loudspeaker leads being fed back to the amplifier input via the feedback network.

The phono preamplifier is similar to that featured in the November 1973 issue of "Electronics Australia". T1 and T2 form a differential amplifier with balanced output to drive the 741 operational amplifier. The sole purpose of using the transistors is to improve the otherwise inadequate noise performance of the 741.

Collector current of the two input transistors is set at about 87uA by the common 82k emitter load resistor. As another measure to minimise noise output, the collectors of T1 and T2 run at the quite low voltage of about 2.4V.

Five components are used in the equalisation network (560k, 56k, .0056uF, .0012uF and 150pF) to give an RIAA response within 1dB.

Low frequency response of the preamplifier is rolled off below 30Hz to minimise rumble reproduction. The roll-off is determined by the ratio of the reactance of the 10uF capacitor to the 1k resistor in the feedback network.

A 47pF capacitor and 1k resistor are used at the phono inputs as an RF attenuation network. This network causes a slight degradation to the signal/-noise ratio of the preamplifier but is a necessary measure (along with others in the circuit) to ensure that the amplifier is not prone to RF breakthrough.

The series network consisting of the 1k resistor and .001uF capacitor between

PERFORMANCE OF PROTOTYPE

POWER OUTPUT	One channel	Both channels
4 ohms	54W	43W
8 ohms	40W	34W
16 ohms	24W	21W
FREQUENCY RESPONSE		
Phono inputs	RIAA equalisation within 1dB from 30Hz to 20kHz	
High level inputs	25Hz to 20kHz ± 1dB	
CHANNEL SEPARATION		
(with respect to 40W)	10kHz	—33dB
	1kHz	—46dB
	100kHz	—48dB
INPUT SENSITIVITY		
Phono at 1kHz	2.8mV	56k
Overload at 1kHz	120mV	
High level inputs	180mV	36k (minimum)
HUM & NOISE		
Phono (with respect 10mV)		70dB unweighted with typical cartridge
Other inputs		70dB unweighted with inputs open circuit
TOTAL HARMONIC DISTORTION		
At full power with both channels operating from 25 to 20kHz: less than 0.3%		
Typically less than 0.1% at normal listening levels		
TONE CONTROLS		
Bass	+ 12, —13dB at 50Hz	
Treble	±10dB at 10kHz	
DAMPING FACTOR		
at 1kHz	> 60	
at 30Hz	> 30	
STABILITY		
Unconditional		

Your next electronic circuit tester should be a Sanwa

N–501

- 2μA suspension movement – 0.05mA/1mV resolution
- Double protection – fuse & Si diode
- Constant 1MΩ input impedance (ACV) – RF-diode rectified current direct to movement
- Revised scale marking – intermediate readings readily determined
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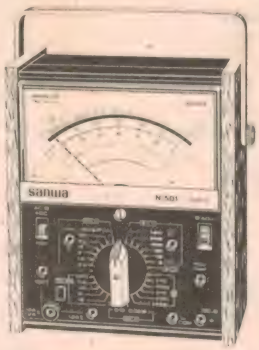
±DCV 0-60mV 0-0.3-1.2.3-12-30V (500kΩ/V) 0-120-300-1.2k (50kΩ/V) ±2% 0-30k (w/HV probe)
±DCA 0-2μS 0-0.03-0.3-1.2-3-12-30mA 0-0.12-0.3-1.2-12 (300mV) ±2%
ACV 0-3-12-30-120-300-1.2k (1MΩ) ±2.5% Freq. 20Hz to 50kHz (±1dB)
ACA 0-1.2-12A
Ω x1 x10 x100 x1k x10k x100k (max. 200M) Batt. 1.5Vx1 & 9Vx1
dB –20 to +63
252x191x107mm 1.95kg



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- 10μA movement – 100kΩ/V, varistor protected
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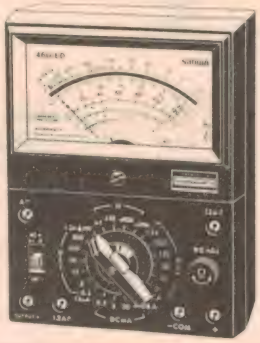
- Equalizing transformer – common shunts & jacks for 1.2A & 12A DC/AC
- Detachable indicator block – easy maintenance
- Accurate DC reading – no HF current interference

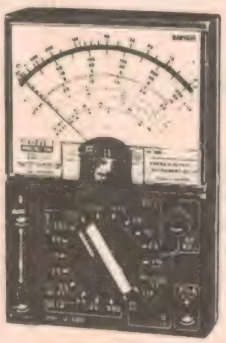


±DCV 0-0.3-3-12-30-120-300 (100kΩ) 1.2k (16.6kΩ/V) ±2% 30k (w/HV probe)
±DCA 0-12μA 0-0.3-3-30-300mA 0-1.2-12A (300mV) ±2%
ACV 0-3-12-30-120-300-1.2k (5kΩ/V) ±3% Freq. 20Hz to 1MHz at 3V
ACA 0-1.2-12 (300mV) ±3%
Ω x1 x10 x100 x10k (max. 50M) Batt. 1.5Vx1 & 9Vx1
dB –20 to +63
184x134x88mm 1.3kg

U–60D

- **Measurement ranges available.**

DCV 0.1 0.5 2.5 10 50 250 1000 (20kΩ/V) (25kV w/HV probe extra)
ACV 2.5 10 50 250 1000 (8kΩ/V)
DCmA 0.05 2.5 50 500 (500mV drop; 100mV for 0.05mA)
Ω Range – X1 X10 X100 X1k Midscale –50Ω 500Ω 5kΩ 50kΩ Maximum – 5kΩ 50kΩ 500kΩ 5MΩ Batteries 1.5V dry cell (UM-3 or equivalent) X2
LI 0.06mA 0.6mA
LV 3V 3V



LI 6mA 60mA
LV 3V 3V

- **Allowance.** Within ±3% f.s.d. for DCV & DCmA Within ±4% f.s.d. (±6% for 2.5V) for ACV Within ±3% of scale length for Ω
- **Size & weight.** 133X92X42 mm & 300 gr

P–2B

- The sturdy midget – quality quality instrument of functional design
- Designed for rugged service – phenol-resin front panel & metal rear case
- Positive range setting – special feature of a pinjack tester
- Reserve instrument – for household or field service

DCV 0-10-50-250-500-1k (2kΩ/V) ±3%
DCA 0-0.5-10-250m (670mV) ±3%
ACV 0-10-50-250-500-1k (2kΩ/V) ±4%
Ω 0-5k 500k Batt. 1.5Vx1
dB –20 to +36
MΩ 0.1–50) using
μF 0.0002–0.6) external power
120x88x40mm 325gr

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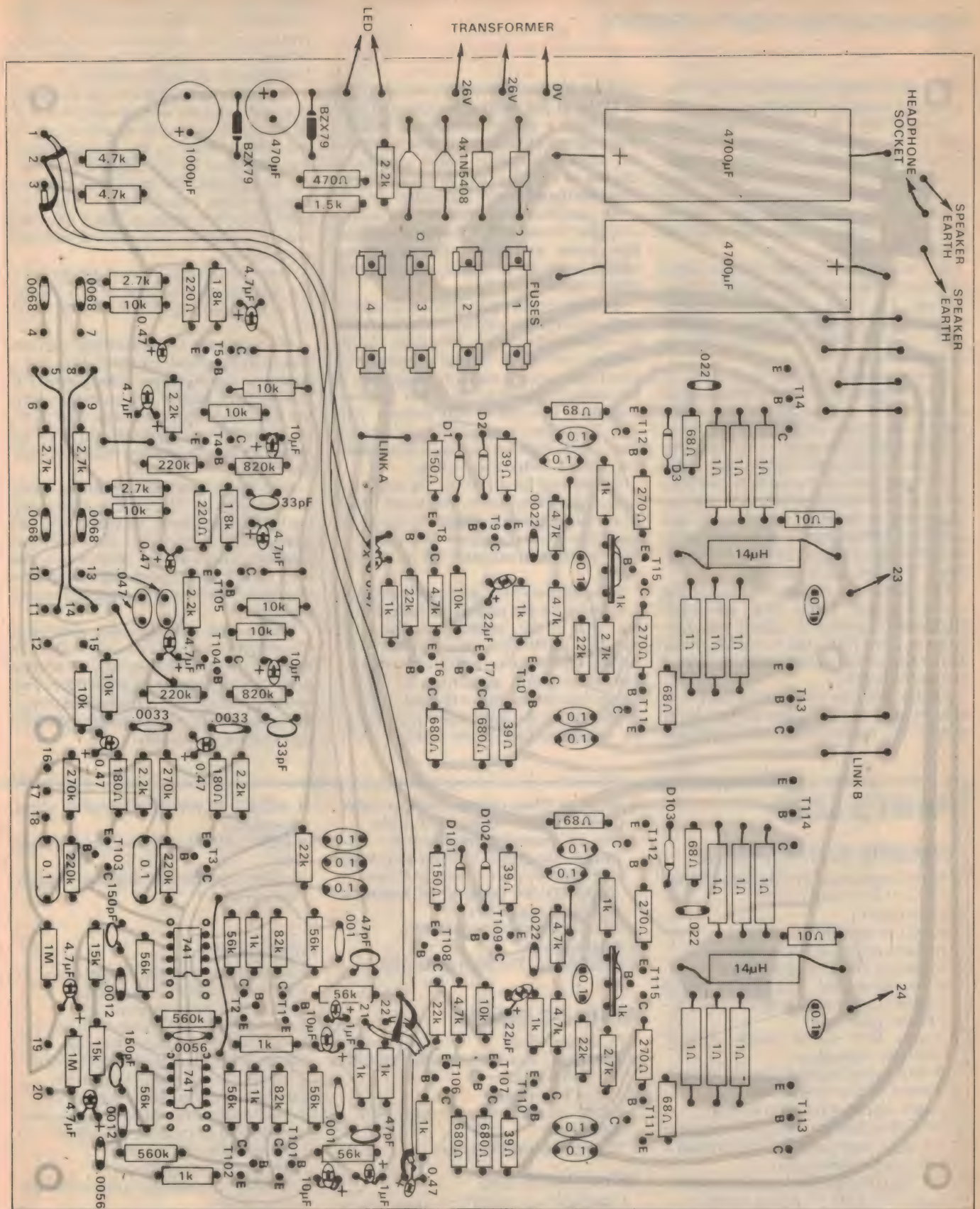


the collectors of T1 and T2 ensures stability of the preamplifier at high frequencies. At the same time, the 15k resistor connected from the output terminal of the op amp to the positive 15V rail provides a standing current of 1mA to minimise cross-over distortion from the class-B output stage of the 741.

Output signals from the preamplifier are coupled via a 4.7uF capacitor to the Selector switch. The negative electrode of the capacitor is connected to the zero supply rail via a 1M resistor to ensure that there are no clicks from the loudspeakers when the phono source is selected.

Supply rails for the preamplifier are plus and minus 15V. This enables the preamplifier output signal to exceed 9V

RMS, which means that it has more than adequate input overload margin.

Signals from the volume control are fed to an emitter-follower stage T3 before passing to the active tone control. T3 provides the required low source impedance for the tone control stage and minimises the loading on the volume control so that it provides smooth progressive action.

The active tone control is basically a negative feedback circuit around stages T4 and T5. T4 is a common emitter amplifier with bootstrapped collector load. T5 is an emitter follower which is an output buffer.

Power supply circuitry is simple. A centre-tapped bridge rectifier circuit produces the positive and negative 35V rails for the power amplifiers. From these rails are derived the positive and negative 15V rails for the small-signal stages. Two 15V zener diodes are used here and they are bypassed with large value electrolytic capacitors to reduce "zener" noise and provide a further degree of hum filtering. The pilot light is a LED run from the negative 35V rail via a 2.2k resistor.

This completes the description of the circuit apart from the optional loudspeaker protector which was featured in June 1976 (File 1/SA/57). Now a brief discussion on the performance of the new amplifier.

Notice that the title "Forty/Forty" is only an approximate guide to the power output. The maximum power figures we give are for continuous sine wave output at 1kHz, at just before the onset of clipping with a mains voltage of 240VAC. Altering any of these parameters slightly, i.e., load impedance, mains voltage or degree of clipping (say to 1% THD) can alter the figures quite markedly.

All specifications refer to the whole amplifier from input to output, not just the power amplifiers. The distortion ratings apply to all inputs, including the phono input.

During normal operation the amplifier output transistors will be cool or just faintly warm to the touch. However, if continuous sine wave testing is performed which produces maximum dissipation in the output transistors they will become extremely hot—up to 120 degrees Celsius. This is hot enough to burn fingers! Even at this high temperature the transistors will be within their ratings.

It is normal for T9, T109, T10 and T110 to become fairly hot to the touch, even when the amplifier is idling. On the other hand, the driver transistors T11, T111, T12 and T112 should normally be cool to the touch.

Some readers may query the operating conditions of the output transistors. It is true that if the balanced supply rails exceed ±35V then the 2N3055 Vcer rating can be exceeded. However, experience with amplifiers of similar design has shown that a breakdown due to this cause is most unlikely. Similarly, the voltage rating of the 4700uF/35VW filter capacitors will be exceeded when the mains voltage exceeds 240VAC. However, the capacitors will still be within their surge voltage ratings so breakdowns are again unlikely.

Assembly can begin with the PC board. Proceed carefully and double check all components as many mistakes can be made here. Refer to the circuit diagram and PC board layout diagram as assembly progresses. No particular order of component installation need be followed other than to insert the long links of hook-up wire before adjacent components.

Transistor designation on the board is the same as on the circuit, i.e., T1, T2 etc., while the duplicate channel is T101, T102, etc.

PC stakes are recommended and any type may be used provided they are a tight fit in the PC board holes before soldering. If PC stakes are used they have the advantage that all connections to the board can be quickly broken to allow the board to be completely removed from the chassis.

Low noise cracked carbon or metal film resistors of ¼W or ½W rating may be used throughout except where we have noted otherwise, on the circuit diagram. Insert all the resistors so that their colour code bands run in the same direction. This makes component checking easier.

Ensure that tantalum and aluminium electrolytic capacitors are correctly inserted, otherwise they will be reverse polarised and rendered ineffective. Tantalum capacitors are coded with a dot (as shown on the PC layout diagram) or plus sign to indicate polarity.

PARTS LIST

CHASSIS & HARDWARE

1 plated steel chassis 370 x 80 x 245mm (W x H x D) with cover
1 front panel
5 knobs to suit front panel
2 miniature SPST toggle switches
1 miniature DPDT toggle switch
1 6.5m stereo jack socket with switch contacts (plus insulating washers)
1 LED for pilot light
2 6-way RCA socket panels, Ralmar M421 or equivalent
1 4-way spring loaded terminal panel, Ralmar ST3 or equivalent
1 rotary 2-pole, 4 position switch
1 100k (lin) dual ganged potentiometer
1 50k (log) dual ganged potentiometer
1 50k (lin) potentiometer
1 25k (lin) dual ganged potentiometer
6 Richco CBS-6N PC board supports
4 rubber feet
6 solder lugs
1 mains cord clamp and grommet
1 3-way insulated terminal block
1 three-pin mains plug and three-core mains cord
1 metre of 10-conductor rainbow cable
2 metres of figure-8 shielded cable
4 sets of mounting hardware for TO-3 power transistors, ie, mica and insulating washers plus screws and nuts
2 .047uF/25VW ceramic or metallised polyester capacitors
1 .01uF/2kV ceramic capacitor
2 4-lug tagstrips
1 transformer DSE M-0148 52V CT

MAIN PC BOARD

1 PC board, 76sa4
8 fuse clips, Swan (McMurdo) FC1 Part No. 1397-01-18
4 2 amp 3AG fuses
2 14uH chokes, Paradio VPC 14A or equivalent
2 1k preset potentiometers

SEMICONDUCTORS

4 1N5408 or 100PIV 2 amp silicon diodes
2 BZX79/C15 zener diodes
6 1N4148, 1N914A silicon signal diodes
4 2N3055 silicon power transistors
4 BD139 NPN silicon transistors
4 BD140 PNP silicon transistors
8 BC547, BC107, BC182 NPN silicon transistors
10 BC549, BC184 NPN low-noise transistors
2 uA741 operational amplifier integrated circuits

CAPACITORS

2 4700uF/35VW pigtail electrolytics
1 1000uF/16VW PC electrolytic
1 470uF/16VW PC electrolytic
2 22uF/6VW tantalum electrolytics
4 10uF/25VW tantalum electrolytics
6 4.7uF/25VW tantalum electrolytics
2 1uF/25VW tantalum electrolytics
6 0.47uF/25VW tantalum electrolytics
17 0.1uF/60VW metallised polyester (greencap) or ceramic capacitors
2 .047 metallised polyester
2 .022 metallised polyester
4 .0068uF metallised polyester or polystyrene
2 .0056uF metallised polyester or polystyrene
2 .0033 metallised polyester or polystyrene
2 .0022 metallised polyester or polystyrene

Quite a diverse range of transistors may be used on the board apart from those in the output stages. TO-92 transistors are preferable to those in metal encapsulation both from the cost angle and the fact that transistors with collectors connected to the metal can are more prone to parasitic oscillation. If you are supplied with substitute transistors not listed in our parts list make sure of the following:
(a) obtain the dealer's assurance that the substitutes are in fact equivalent and
(b) obtain from him a diagram of the lead connections.

As a precaution against instability we recommend fitting a ferrite bead, type FX1115, to the base leads of T3 (and T103). Sleeve the base lead before fitting the bead. This is to prevent noise caused by the bead's finite resistance altering the bias conditions of the transistor. It is not necessary to sleeve the emitter and collector leads.

Take great care in inserting transistors. Notice that the BD139 and BD140 driver transistors are differently oriented—the metal flat on the BD140s faces to the rear of the chassis while on the BD139s it faces to the front. Notice also that T9 (T109) and T10 (T110) are differently oriented. The metal flat on T10 (BD140) faces to the rear of the chassis, while for T9 (BD139) the metal flat is on the side facing away from the power transformer.

While we have designed the copper pattern around 14-pin ICs for the 741s, the PC board is also compatible with both the 8-lead "mini-dip" and 8-lead metal can versions of the 741. This is by virtue of the fact that pins 1, 2, 7, 8, 12, 13 and 14 have no internal connection (on the 14-lead IC), while the remaining pins have the same orientation as in the smaller packages.

For both 8-lead packages, pins 1 to 4 connect to pins 3 to 6 of the socket pattern and similarly, pins 5 to 8 should connect to pins 9 to 12 of the socket pattern. The PC board layout diagram shows mini-dip ICs in position.

We used 1N5408 rectifier diodes as supplied by Dick Smith Electronics. These have the advantage of economy, but if they cannot be obtained any power diodes with a rating of at least 2 amps at 100PIV will suffice.

Notice that diodes D3 and D103 point in opposite directions on the PC layout diagram.

8 Swann (McMurdo) FC1 fuseclips are used on the PC board. These are inserted and the solder tags crimped on the copper side before soldering to ensure that they are mechanically secure. But do not insert the four fuses until after the setting-up procedure has been successfully completed.

Six 1 ohm/1W resistors are used in each power amplifier output stage. These are used instead of equivalent resistors of higher rating, because they are cheaper and often more freely available. However, if the 1 ohm/1W resistors cannot be obtained, two 0.33 ohm/5W resistors can be used for each power amplifier.

The 14uH chokes are wound with eighteen turns of 20 B&S enamelled copper wire on a special grade of ferrite rod 30mm long and 10mm diameter. Ordinary ferrite rod used for AM radio antennas is not suitable. We understand that at least one kit retailer will be supplying ferrite rods of correct grade plus wire. Alternatively, Paradio Electronics, 7a Burton Street, Darlinghurst, NSW, can supply trade requirements for finished chokes which have type number VPC14A.

A length of shielded cable is required to connect both of the amplifier inputs to the balance control terminals. This is to tie the power amplifier input earth points to the rest of the board earth network. Leave the inner conductors of the shielded cable disconnected from the amplifier inputs for the time being.

This completes assembly of the PC board. Next month we will describe the installation of hardware in the chassis, and detail the setting-up procedure. A useful trouble-shooting procedure will also be included for those who run into difficulties.

2 .0012uF metallised polyester or polystyrene
2 .001 metallised polyester or polystyrene
2 150pF ceramic or polystyrene
2 47pF ceramic or polystyrene
2 33pF ceramic or polystyrene

RESISTORS

(5% tolerance, ¼W, unless otherwise noted)
2 x 1M, 2 x 820k, 2 x 560k, 2 x 270k, 4 x 220k, 2 x 82k, 8 x 56k, 5 x 22k, 2 x 15k, 10 x 10k, 10 x 4.7k, 6 x 2.7k, 5 x 2.2k, 2 x 1.8k, 1 x 1.5k, 12 x 1k, 4 x 680 ohms, 2 x 470 ohms/1W, 2 x 330 ohms, 4 x 270 ohms, 2 x 220 ohms, 2 x 180 ohms, 2 x 150 ohms, 6 x 68 ohms, 4 x 39 ohms, 2 x 10 ohms/½W, 12 x 1 ohm/1W, 4 x 100 ohms/1W (see text).

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for out prototype. Where voltage ratings are not quoted, they should be 50V or more. Components with higher ratings may also be used provided they are physically compatible.

Simple to make—intriguing to use:

A telephone amplifier

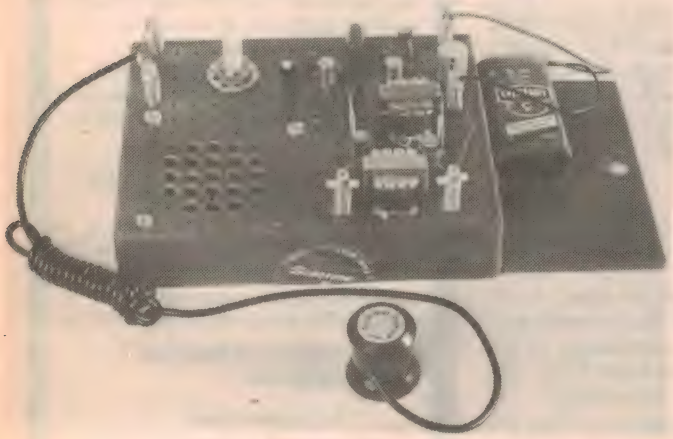
Here's a little gadget that will allow you to listen to both sides of a normal telephone conversation. While a rather primitive device in some ways, it does provide the basis for a good practical lesson and it may also open the way to the construction of something a little more ambitious.

by WALTER NEVILLE

The idea behind the gadget is simple enough: we have all had the experience of having to listen to one side of a phone conversation in which we were vitally interested; say with an old friend or a sick relative. After it's all over, the person who took the call has to try to remember what the other person said.

And there's another situation, all too familiar in the office: we call someone who is busy and are asked to wait on, which usually means sitting in enforced idleness, with one hand holding the phone. With a suitable listening aid, it may be possible to lay the handset down until a voice says: "Putting you through now, Sir".

Or that most frustrating question: "Were you waiting on somebody?"



Our version of the amplifier. At centre top is transistor Q1 with Q2 to the right of it. Q3 and Q4 are towards the front between the two transformers. Note the enlarged holes in front of the speaker.

Superficially, it would seem to be quite easy to dream up a gadget to overcome such problems: Simply make a connection to the phone line and feed the signal into an amplifier and loudspeaker, so that everything on the line is amplified to comfortable listening level.

Unfortunately, it isn't quite as easy as that, because telephone authorities have some very rigid rules about what can be connected to their lines, and who by! In any case, a suitable isolating transformer would have to be used, otherwise direct connection of an amplifier, particularly one linked to mains or earth, could cause complications.

So, if a signal is to be picked up from the phone for amplification, it has to be picked up inductively – that is, by a suitable iron-cored coil, taped to the handset or to the body of the instrument, where it will sense the tiny stray magnetic fields radiated by the telephone's own inductors.

A decade ago, it was a fairly simple operation, because the inductors in the then-current instruments had quite a strong stray field, relatively easy to intercept. With the more modern handsets, the stray field is much weaker, calling for a more efficient pick-up coil, more critical placement on the phone and more amplification.

Unfortunately, a pickup system with increased sensitivity is likely also to be more sensitive to stray fields from the 50Hz power wiring. Thus, if the signal in the phone is on the weak side, the pickup coil and amplifier will produce mainly 50Hz buzz, with very little voice. So the amplifier circuit has to be tailored to discriminate as much as possible against "hum" frequencies, while still leaving enough of the voice frequencies to preserve intelligibility.

One other point has to be watched: If the sensitivity of the loudspeaking system is too high, it may produce obvious acoustic feedback into the telephone microphone; the whole system will howl, unless the gain is turned down, or the handset is moved further away from the loudspeaker.

If one sets out, therefore, to produce a serious telephone amplifier, it tends to develop into a fairly complex piece of equipment, taking account of both electrical and functional requirements. It might typically be mains operated to save batteries; it might be built into a decorative phone stand to avoid having an awkward thing like an amplifier on the table or shelf; it would have convenient controls so that it could be adjusted or turned down as necessary; it might have a second cradle for the handset, while awaiting a call, and so on.

By the time one gets through such an exercise, there is a tendency to question whether it is warranted so that, in practice, telephone amplifiers rarely emerge either as a do-it-yourself project or as a commercial product.

That is, until one looks through the Tandy Electronics catalogue and comes across their Science Fair "learn while you build" kit 28-116. Retailing at $11.95, it makes no attempt at being decorative or functional but it has one important feature in its favour: it exists and it therefore provides the interested reader with a starting point!

At the time of writing, Tandy advise that their stocks of this kit are rather limited, so first in—first served. But if you miss out, there is no reason why the circuit cannot be built from standard bits and pieces available from most electronics suppliers. More about this later.

We imagine that some readers will build it up, learn by so doing, play with it for a while, and then strip it down to recover the components for the spare parts box. They may even use the pickup coil to feed telephone signals to a tape recorder via the mic. socket. Others may be inspired to rebuild the gadget into a decorative and functional case deserving of a more permanent place in the home or office.

This is up to you.

As with most others of these little Science Fair kits, the instructions suggest building the telephone amplifier on the red plastic box in which the parts are packaged. The box is coded with letters and numbers which form the basis for the step-by-step construction leaflet. If the uninitiated constructor reads through the leaflet, follows each step and checks it off, a complete and working telephone amplifier should result.

Rather than clip the component leads

short, we would favour keeping them to normal length, merely bending them aside and soldering as necessary. If you do want to recover the parts, or decide later to assemble them in another physical form, they can be unsoldered and the leads straightened, ready for re-use. In fact, the layout of a little amplifier like this is not at all critical and it can be built up in almost any form you like, provided the proper electrical connections are made.

And, speaking of electrical connections, make sure that you carefully identify the emitter, base and collector connections on the transistors from the literature in the kit, before actually installing them. The way the leads go in the pictorial diagram isn't quite as clear as the drawing might suggest and it is very easy to get them mixed up.

The other small point we noticed is that one of the transformers is supposed to be "painted red", to distinguish it from its companion unit. In the sample kit, the top of the transformer had indeed been hit with a red mist from a spray gun, but so fine that we completely overlooked the few tiny red droplets the first time around!

Otherwise, everything went together as intended.

We did make one deliberate modification, which will be evident from the photograph. The instructions suggest that the loudspeaker be mounted inside the red plastic box, so that it radiates only through the tiny holes already provided in the box. Guessing that the unit would not have any power or sensitivity to spare, we drilled the holes in front of the speaker to 3/16in — before the speaker was mounted of course!

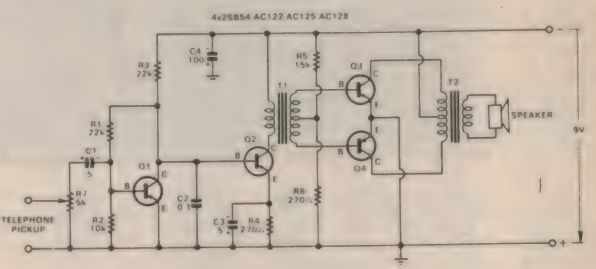
The circuit used in the 28-116 kit is conventional, and the sort of thing that was almost universal as the audio amplifier in the first generation of transistorised portable radios.

The input signal — in this case from the telephone input coil — is fed to a 5k volume control, and thence via a capacitor to the base of an ordinary general purpose PNP germanium transistor. Its emitter is connected directly to the "earthed" positive supply rail, while two series resistors from collector to emitter provide the requisite forward bias for the base. The collector itself is supplied from the —9V line through a 22k resistor, across which the amplified signal appears.

The collector of the first transistor is coupled directly to the base of the second, so that it shares the same signal and the same DC potential. It is bypassed to the earthy line by a 0.1uF capacitor which drastically reduces the response of the circuit to the higher audio frequencies, minimising the unnecessary noise and distortion components from the input signal, without detracting from voice frequencies.

Since the base of the second transistor operates at a significant negative potential, it is necessary to allow the emitter also to move towards the negative potential so that the transistor will have only a modest effective forward bias. This is accomplished by providing a fairly large value of emitter resistor, bypassed by a capacitor to obviate any loss of gain due to emitter feedback. The collector of the transistor runs to the —9V supply through the primary winding of a small interstage transformer.

The circuit of the phone amplifier is conventional, even if somewhat dated. The main points to watch during assembly are the correct identification of the transistor leads and the polarity of the electrolytic capacitors. A larger, more efficient speaker will improve results considerably.



As the collector current through the primary winding of the transformer varies with the signal, it induces signal voltage in the secondary winding, the signals at the two outer ends being of equal amplitude but opposite phase. The signals are fed to the respective bases of the two output transistors operating in what is known as push-pull class-B.

In broad concept, the "push-pull" part of the term signifies that the two output transistors complement one another in supplying drive to the output transformer and thence to the loudspeaker.

If no signal is present, a similar order of current flows from the centre-tap of the output transformer to the respective collectors; since the currents are flowing in opposite directions, they tend to cancel in their magnetising effect on the transformer core.

When out-of-phase signals are applied to the bases of the respective output transistors, the collector currents no longer balance. Thus, at a particular instant, the base of the upper transistor may receive a negative-going half cycle of signal, which will increase its collector current; at the same instant, the lower transistor will receive a positive-going signal, thereby decreasing its collector current.

On the next half-cycle of input signal, the reverse happens.

Thus the two transistors tend to complement one another in varying the normally balanced currents through the output transformer primary, and therefore in modifying the magnetic field in the transformer core. And, as the magnetic field changes, current is induced in the secondary winding and passed to the loudspeaker voice coil.

The "class-B" part of the definition implies that the transistors have only a small amount of forward bias — applied through a 15k and a 270 ohm resistor— so that they draw only a very small cur-

Try this hum-bucking trick

As mentioned in the body of this article, a problem with inductive pickup is that of 50Hz pickup from the mains. Just how serious this is depends on several factors; the location, the "tailoring" of the amplifier's low frequency response, and the strength of the incoming signal.

This latter factor can vary over a very wide range. The strongest signal will probably ride over most hum problems, but the weakest ones, which may still be adequate as a telephone signal, can easily be drowned by typical hum levels.

We considered various possible solutions. One was to provide a "notch" circuit tuned to 50Hz; something which can be provided relatively easily these days, using low cost ICs. (p 81, Electronics Australia, November 1976.)

Such an arrangement would undoubtedly provide considerable benefit, but it does have one limitation. It can only reject the fundamental 50Hz signal; it can do nothing about the harmonics (100Hz, 150Hz, etc) which, in many cases, are quite strong.

Then we had another idea. Could the hum be cancelled by picking up an equal but opposite signal containing hum only? To cut a long story short we borrowed another pickup coil from our friendly neighbourhood supplier, connected the two together appropriately — and it worked. Using a "worst case" set-up, the hum dropped from a nasty background to virtual inaudibility.

To provide the required phasing we connected the two outer shields together and took the signal from the two active leads. The two pickup coils were place side by side in the handle slot in the back of the phone, one in the best place to pick up signal, and the other as far from it as possible.

In theory this arrangement leaves the wiring unshielded against electrostatic pickup. In practice, at the relatively low impedance involved, hum from this source was negligible.

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AMPLIFIER. Power Output at 8 Ohms: 44 watts per channel minimum RMS from 20-20,000 Hz, with no more than 0.5% total harmonic distortion. **Frequency Response:** 20-25,000 Hz ± 2dB. **Signal-to-Noise Ratio:** 60 dB. (phono); 85 dB (aux). **FM TUNER. Sensitivity (IHF):** 2.0 μV. **Capture Ratio:** 2 dB. **Alternate Channel Selectivity:** 70 dB. **Stereo Separation:** 35 dB at 1 kHz. **Total Harmonic Distortion:** 0.5% stereo; 0.5% mono. **Signal-to-Noise Ratio:** 65 dB. **AM TUNER. Sensitivity:** 250 μV. or 20 dB. **POWER REQUIREMENT:** 240 VAC, 50 Hz **SIZE:** 14.92x48.49x36.83 cm (5⅞x19¼x4½").

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rent under quiescent (or no-signal) conditions. This being so, most of the change in the magnetic status of the core is brought about as the output transistors in turn draw more current on successive half-cycles of the input signal; in this case, where they receive a negative-going signal pulse.

While much could be said about class-B operation, it has two particular attractions in simple, inexpensive amplifiers: it minimises drain on the battery and it also minimises dissipation in the output transistors.

In fact, the kit supplies simple general purpose PNP germanium transistors for all positions. The only concession is in the provision of "flag" heat sinks for the two used in the output stage — just in case they are called on to handle a continuous loud signal, sufficient to cause some temperature rise.

Because this general type of amplifier was almost universal in the first generation of small transistor sets, it may in fact be possible to adapt the audio end of a discarded transistor receiver as a telephone amplifier, feeding a pickup coil into the volume control circuit in lieu of the original radio signal for the detector. Similar amplifiers have also been used in small intercom systems and it would be worth looking for a discarded one of these.

So much for the circuit. How does it all work out in practice?

Instructions in the kit suggest that the pickup coil, with its suction cup, be attached to the rear of the handset just behind the earpiece. This may be okay with some handsets (presumably American) but with local handsets more pickup was evident with the coil right at the end adjacent to the earphone.

Picking up the signal near the earphone has an important advantage in that the amount of energy from the local microphone and the distant voice is fairly well balanced. Unfortunately, however, the signal is quite limited and may not be enough with many handsets to drive the amplifier when the distant voice is weak.

A much larger signal is available, with local handsets, from inside the handle slot at the rear of the instrument. Lift the receiver so that the dialling tone is heard, and you will soon be able to select the point of strongest pickup. Here, dialling tone, selector clicks and local voice will all be very loud relative to the distant voice but there may be no real choice if the amplifier is to be adequately driven.

At best, however, one of the limiting factors in the 28-116 kit is the tiny speaker and the fact that the listening has to be done right near the phone. The leaflet suggests that a clearer signal will be obtained if the amplifier is used with a larger, more sensitive 8-ohm speaker—particularly if you place it where you can listen conveniently. Then you should be able to hear both sides of the conversation with less distraction.

Another possibility, which is well worth considering, is that of using the amplifier with a miniature earplug, connected in lieu of the speaker. Ordinary 8-ohm magnetic units appear to work very well.

Earlier we suggested that components should be available from sources other than the Tandy kit. Those worthy of special mention are the pickup coil, the transistors, and the transformers.

The transistors are general purpose PNP types and several alternative type numbers are given in the circuit. At least one of these types should be readily available.

Pickup coils will probably be available from Tandy as a separate item, but we found them available in at least two other Sydney stores: Radio Despatch Service and Dick Smith Pty Ltd. We imagine they would be as readily available in other states.

The same two stores should also be able to supply transformers. The output transformer should have a centre tapped primary with an impedance of around 400 to 500 ohms and an 8 ohm secondary. The driver transformer should have a primary of about 2500 to 3000 ohms, with a similar secondary, centre tapped.

Construction should not present any serious problems. As we said earlier, layout is not critical and so it may be built in almost any form. A piece of Veroboard would probably make a good substitute for the plastic box.

Versatile new design offers several options:

Modular Digital Clock

Here is our simplest-ever digital clock project. In its basic form, all that is required is a clock module, a transformer, two switches and a case. But if desired it can be expanded to include alarm, snooze, sleep and radio switching functions.

by DAVID EDWARDS

At the heart of this new digital clock is a new clock module recently released by National Semiconductor. Designated the MA1002 LED display electronic clock module, it is available in eight different versions. Current retail price of individual modules is currently around the $14.00 mark.

Each module consists of a monolithic MOS-LSI integrated clock circuit, four digit 13mm LED display, power supply and other discrete components, all mounted on a single printed circuit board. Perhaps the most unusual feature of the assembly is that both the clock chip and the display LEDs are mounted directly onto the circuit board, without the use of conventional IC packages.

As you can see in the accompanying photographs, the clock chip is centrally mounted under a blob of epoxy. The LEDs are mounted on the other side of the board, and protected by a red plastic lens, which also serves to provide optical magnification for them.

There are only fifteen other discrete components on the board, and these are dominated by a power transistor and its associated heat sink. The overall size of the complete module is a tiny 77 x 35 x 17mm.

All that is required to turn the module into a functioning clock is a mains transformer and switches, as well as the usual mains lead and mounting hardware. Eight different modules are available, and these are distinguished by suffixes A to H. Modules A, C, E, and G, are all intended to operate from 60Hz mains supplies, and are not of much interest to us at this stage.

Modules B, D, F and H are the 50Hz versions. Types B and F have a 12 hour display (with PM indication) while types D and H have 24 hour displays. Types B and F are intended as clock radios, while types D and H are intended as alarm clocks.

All modules have alarm facilities, incorporating a nine minute "snooze" delay. This turns off the alarm for nine minutes, and then sounds it once more. This process can be repeated for an hour (by which time you will be very late for work!).

Provision is made for varying the display intensity, either manually or automatically (using an LDR or similar device). There is also a sleep output which allows a radio or similar device to be turned off after a programmable delay of up to 59 minutes.

Let us consider first the alarm clock versions (F and H). These versions incorporate an additional small signal transistor, connected as an oscillator controlled by the alarm output of the clock chip. This oscillator is intended for use with a low cost earphone audio transducer, which must have a resistance of 500 ohms and an inductance of 100mH.

All that is required to build an alarm clock with snooze facilities is this earpiece, along with the clock module, transformer, case and switches. Construction is reduced to mounting the various parts in the case, and wiring them together.

Note that the sleep facility is included with the alarm clock versions, so that if desired, a radio or similar appliance can be controlled by the clock as well. This is done in the same way as for the clock radio versions, which will be described next.

The clock radio versions (types B and F), differ from the alarm clock versions only in that the alarm oscillator is not included. However, the alarm output is still available, so that this can be used to control a separate alarm unit.

The most commonly available module will be the B type (12 hour 50Hz clock radio), so our discussions from now on will centre on this type. The other types of module are essentially similar, so that the circuits to be presented can be used with them.

Fig. 1 shows the basic clock circuit. A transformer is required with two secondary windings, connected as shown. The 16V winding should have a current rating of at least 25mA, while the centre-tapped 10V winding should be able to supply up to 250mA. One end of the 16V winding is connected to the centre tap of the 10V winding.

The 16V winding is used to power the clock chip itself, while the other winding supplies the display LEDs. This reduces the dissipation in the display drivers. The display is driven directly (i.e. it is not multiplexed), so that radio interference is reduced.

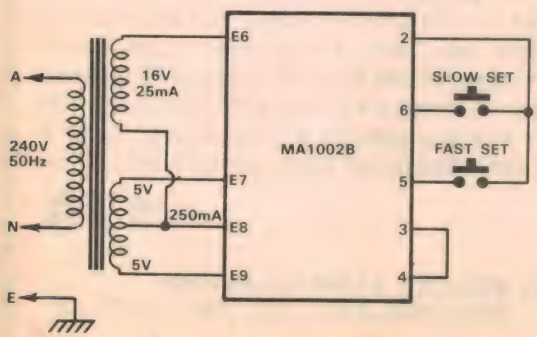


FIG. 1 **BASIC CLOCK**

The circuitry shown at left is all that is required to make up the clock in its most basic form. The basic clock module can be purchased with either a 12 or a 24 hour display.

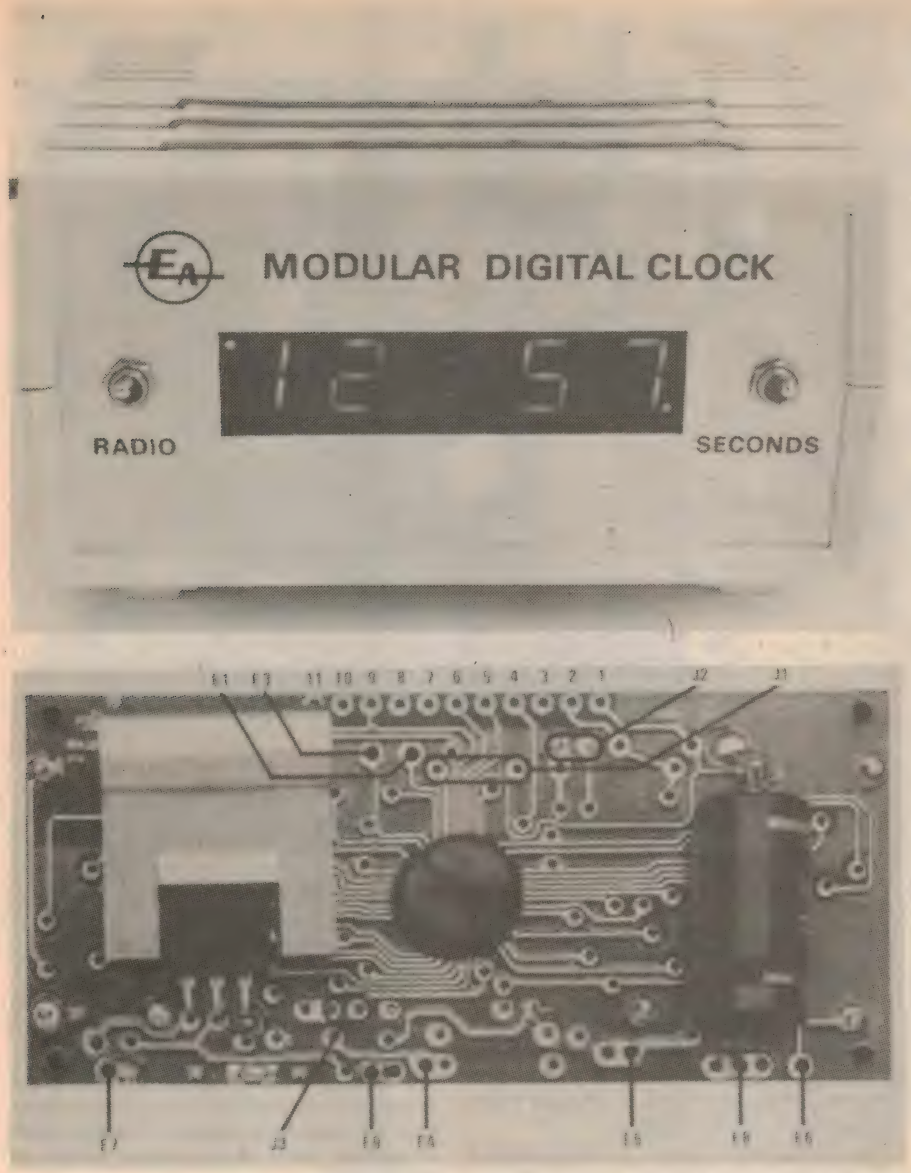


Fig. 2 (above) shows the location of the various connection points on the clock module. Exercise due care when soldering to the board, as discussed in the text.

PARTS LIST

BASIC CLOCK

1 National Semiconductor MA1002B clock module (see text)
1 transformer, 240V to 16V and 10VCT (A & B 9827, J.T. 197 or similar)
2 momentary contact switches
1 case, see text
2 aluminium clamps, see text
Solder, hookup wire, machine screws, mains cord, cord clamp, grommet terminal block

EXTRA PARTS FOR FULL FEATURE CLOCK

1 printed circuit board, coded 76cl12, measuring 76 x 50mm
1 BC548 NPN transistor
2 BC558 PNP transistors
1 C106Y1 SCR, or BRY39 SCS, or similar
2 EM401 silicon diodes
1 1N914 silicon diode
1 3.6V 400mW zener diode
1 ORP12 light dependent resistor
1 22k trimpot
1 10M, 1 100k, 3 10k, 1 6.8k, 1 1k ¼W resistors
1 470uF 25VW PCB mounting electrolytic capacitor
1 100uF 10VW PCB electrolytic capacitor
3 SPST miniature toggle switches
1 SPDT centre-off miniature toggle switch
1 alarm unit, see text
1 radio unit, see text
Tinned copper wire, rainbow cable, machine screws
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.

To implement the basic clock, only two switches are required. These should be momentary contact types, and are used to set the time. They are connected as shown between pads 2, 5 and 6 of the module, with a link connected also between pads 3 and 4.

When power is first applied, the display will show some random time, and it will be flashing at a 1Hz rate. This is the power failure indicator. When either of the time setting switches is operated, the display will remain steady, with the colon flashing at one second intervals. This shows that the clock is counting, and also gives some indication of the passage of seconds.

PM indication is by means of a small dot in the upper left hand corner of the display. When this is illuminated, the clock is in the PM phase.

Fig. 2 shows the location of the various connection points on the clock module. If desired, this simple clock can be assembled, either for use as it stands or preparatory to adding the more exotic functions, such as the alarm and radio features.

Turning now to Fig. 3, we can discuss the full feature clock. Switches S1, S2, S3 and S4 are all momentary contact types, and control respectively setting of the time, setting of the snooze, and seconds display facilities. When this latter switch is operated, the display shows minutes, tens of seconds, and seconds.

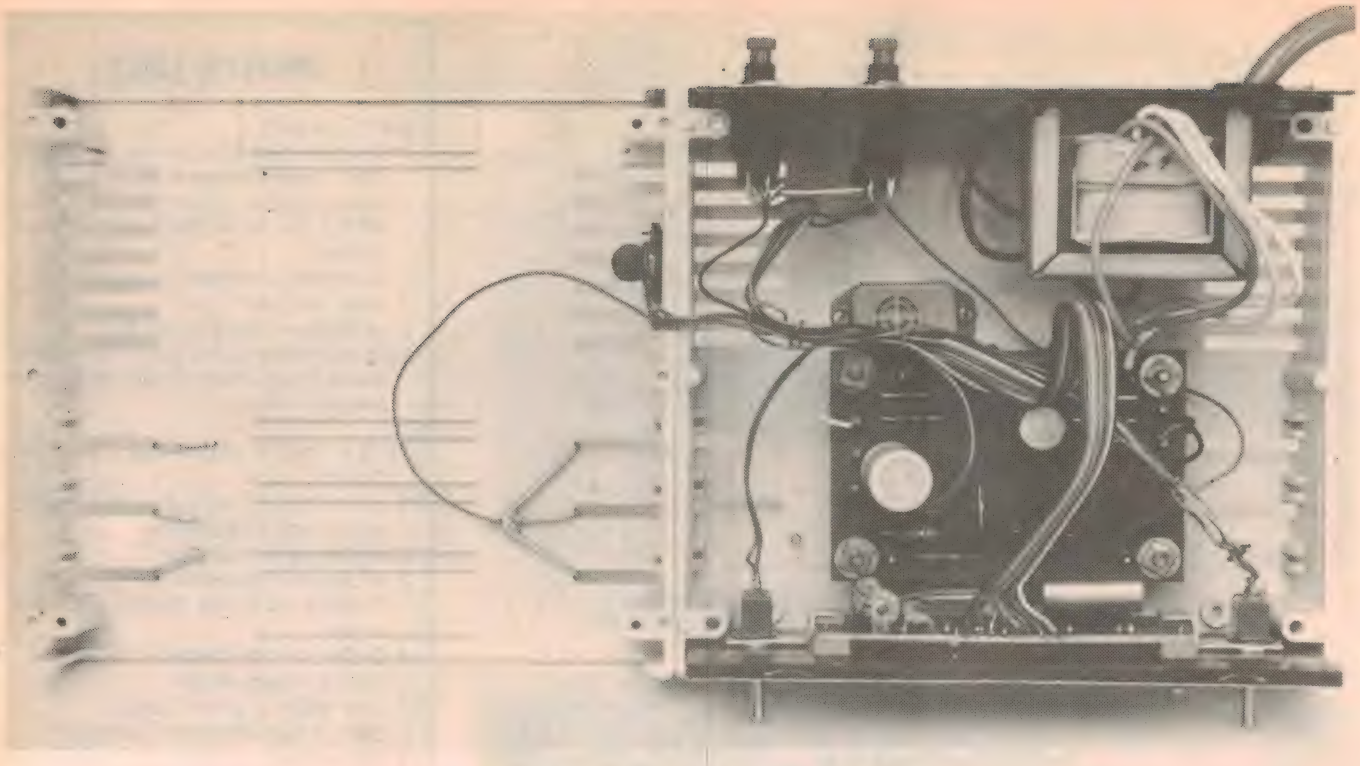
Switch S5 is a single pole toggle switch, and serves to turn the alarm facility on and off. When this switch is in the on position, a small dot in the right hand bottom corner of the display is illuminated.

Switch S6 is a three position toggle switch, with a centre off position. This is used to enable the time setting switches to set the alarm time and the snooze time as well.

Automatic variable intensity of the display can be added quite simply, as shown. All that is required is a 22k trimpot, and an ORP12 LDR (light dependent resistor). These are connected in parallel, and inserted in the link from pad 3 to pad 4.

The next additional feature we have provided is a touch switch to allow convenient activation of the snooze facility. This is based on the Proximity Switch presented in the November 1976 issue by fellow staff member Leo Simpson. We have amended his circuit considerably, as our requirements were different, and this has reduced the component count.

Our circuit uses a silicon controlled rectifier (SCR), one BC558 transistor, and four resistors. The cathode of the SCR is connected to one end of the 16V secondary winding via a 6.8k resistor. The anode



is connected to pad 2 of the clock module via a 1k resistor.

Pad 2 is connected to pad E8 by the wiring on the PCB, so that an AC waveform is applied across the SCR. When a hand or similar object approaches the touch plate, the increased capacitance triggers the SCR, which then conducts on every alternate half cycle.

The current pulses through the SCR also flow through the 1k resistor, and thus turn the transistor on. The collector of this transistor is connected to the snooze input, pad 8, and thus shorts this pad to pad 2.

Since the transistor is being turned on and off once in every mains cycle, this has the effect of operating the snooze facility at the same rate. This does not affect the snooze operation, but does affect the display.

This is because operation of the snooze switch also changes the display from normal time to the alarm time, so that the display alternates between the two at a 50Hz rate. The visual effect of this is that the two times are combined, producing strange displays like 4 : 98 (from 4 : 46 and 1 : 31).

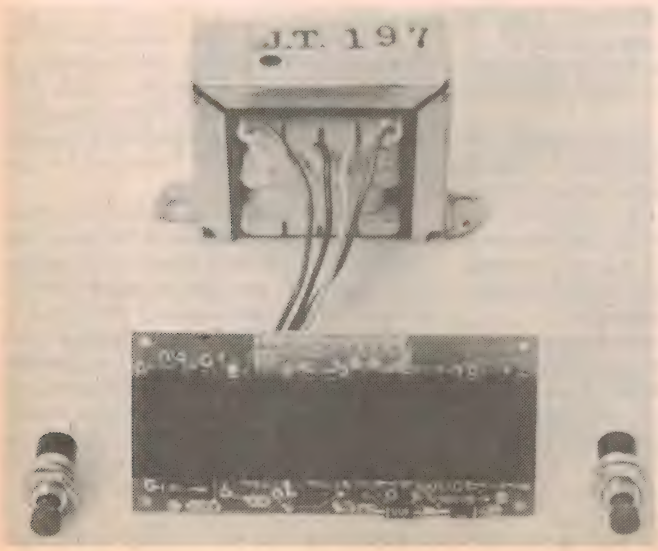
However, as this only occurs for the short time when one's hand is covering the touch plate, we felt that it was not objectionable, and did not warrant extra components to eliminate it.

The remaining features we have added are the alarm and radio drivers. These derive their power supplies from the 10V winding, via two silicon diodes and a 470uF electrolytic capacitor. Each circuit uses a BC548 transistor, to buffer the outputs from the clock module.

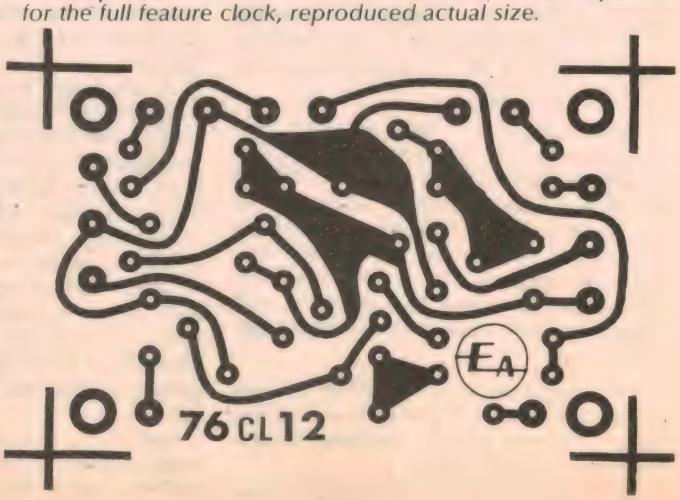
The alarm circuit uses the transistor as a switch, with the load formed by the alarm itself in the collector circuit. The 1N914 diode prevents the base-emitter junction from being reversed biased. The alarm unit can be a solid-state buzzer of the type available from Dick Smith Electronics Pty Ltd, or a Sonalert or similar device. Alternatively, a multivibrator could be used to drive a small speaker.

The important requirements of the alarm unit are that it should operate from a 6V DC supply, and that its current drain should be fairly small, in the order of 20mA or so.

The radio circuit uses a switched regulated power supply to provide a nominal three volts to the radio. This is achieved by using a 3.6V 400mW zener



The photograph at left shows all the components needed to make up the basic clock circuit. Below is the PC board pattern for the full feature clock, reproduced actual size.



diode to stabilize the base voltage of the transistor. If higher supply voltages are required, a higher valued zener can be used.

The supply is switched on and off by supplying the zener current directly from the sleep output of the clock module, via a 10k resistor. If a manual switch is required, this can be added by connecting the cathode of the zener diode to the 0V rail (pad E8 or pad 2), via a suitable switch and another 10k resistor.

If a considerably higher supply voltage is required for the radio, say 9V, then it will be necessary to use the 16V winding for this. This will require one extra diode and filter capacitor, which must be connected between pad E6 and pad E8 so as to produce a negative voltage with respect to pad E8.

A 10V zener would then be required, with the anode returned to the new negative rail, along with the negative radio terminal. Note that the current drain which can be taken from this winding is reduced compared to that available from the 10V winding.

Note also that as we have drawn the circuit, the alarm and radio circuits are quite distinct. If it is desired to dispense with the alarm, and use the radio as an alarm as well, then the alarm sections can be left out, and pad E3 connected to the 10k resistor used for the manual radio switch.

Construction of the clock is very easy, and should be within the capabilities of most readers. We used one of the plastic cases from A & R Soanar, measuring 140 x 85 x 130mm. These are of modular construction, and are supplied with a plastic front panel and a metal rear panel. They are available in a variety of colours.

As you can see in the photographs, we mounted the transformer and associated components on the rear panel, and the clock module on the front panel. This was achieved by making a rectangular cutout in the plastic, for the display lens, and pushing the module through from the rear. It is held in place by two small brackets clamped behind the two front panel switches.

Details of the brackets are given in a diagram elsewhere in the article. We used small pieces of foam rubber between the clamps and the module, and between the module and the panel. This gave a firm mounting, without damaging the module.

For the basic clock, all that remains to be completed is the wiring between switches, the module and the transformer. We used small momentary contact pushbutton switches for the basic clock, and completed the wiring with short lengths of colour coded hookup wire.

At this stage, it is appropriate to caution readers that some of the pads on the module are connected directly to the clock chip, which is a MOS device, so that caution with regard to static voltages is required during assembly. The module is supplied with a conductive strip joining

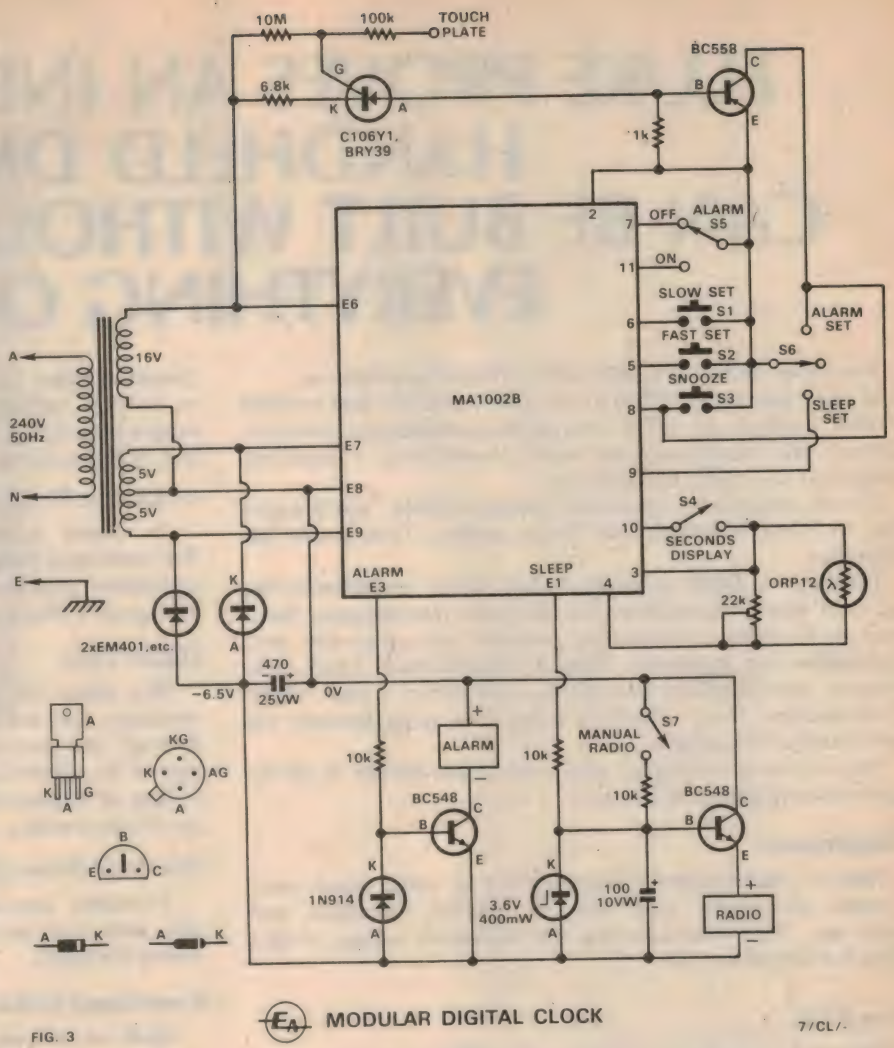


FIG. 3

MODULAR DIGITAL CLOCK

7/CL/-

The circuit diagram for the full feature clock. Note that snooze switch S3 is deleted if the optional touch plate circuitry is incorporated.

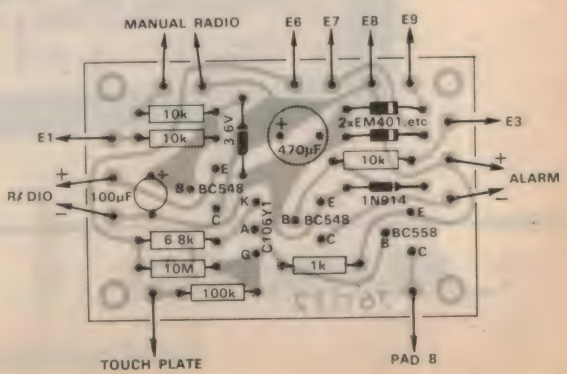
pads 1 to 11, and this should not be removed till the last moment.

Your soldering iron should be earthed, and connected to the positive side of the 100uF electrolytic capacitor on the rear of the clock board. The wires should be joined to the module by inserting their stepped ends in the relevant holes, and quickly soldered, using a minimum of heat and solder.

Testing simply consists of applying power and checking that the clock operates correctly. When power is first applied, the display should flash at a one second rate. This should stop when either of the time setting switches is operated.

In order to simplify construction of the full feature clock, we have designed a small printed circuit board, coded 76cl12, and measuring 76 x 50mm. This board accommodates the circuitry for the alarm and radio driver circuits, as well as for the touch switch.

This is mounted on the bottom of the case, using the four corner holes provided, and connected up to the transformer and module with colour coded



Component overlay on the PC board for the feature clock. Use circuit board pins to facilitate external connections.

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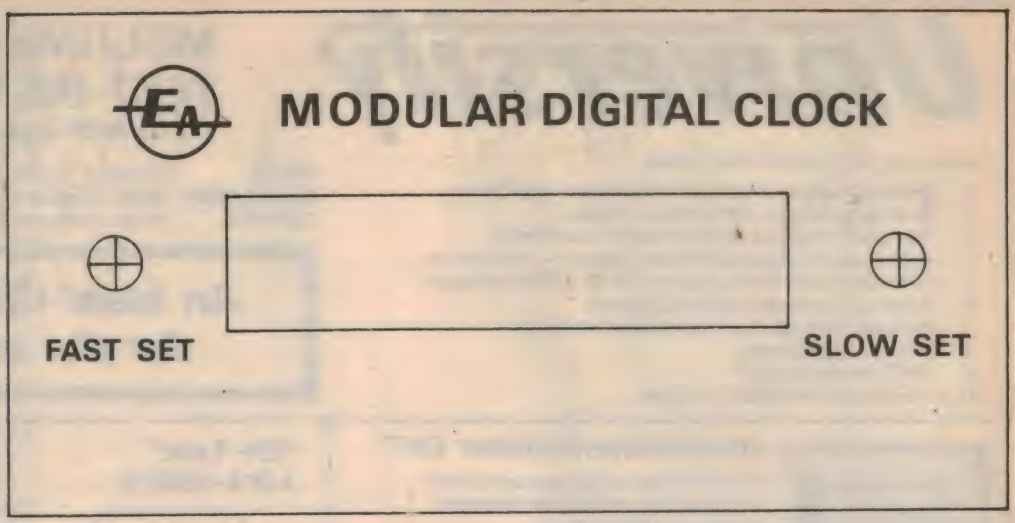
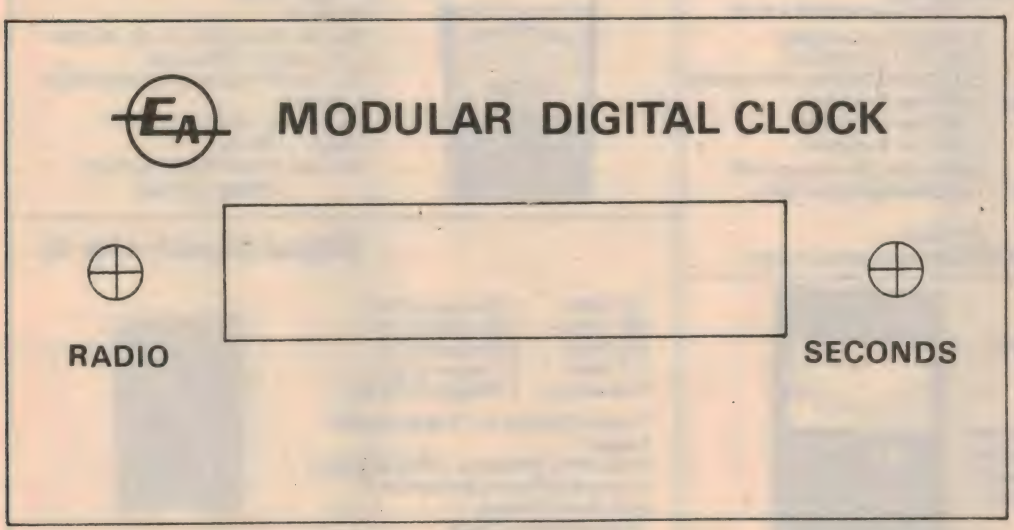
Right: actual size reproduction of the front panel for the basic clock.





Left: actual size reproduction of the front panel for the feature clock.

hookup wire. Fourteen external connections to the board are required, and these are best made with circuit board pins.

No difficulties should be experienced in placing components on the board. If you are using the BRY39 dual gate SCR, cut off the anode gate (AG) close to the device body, and then treat it as an ordinary SCR.

If you do not wish to add all the features to the clock, simply leave out those components not required. The LDR used to control the display intensity can be glued underneath one of the slots in the top of the case, with the trimpot soldered directly across the leads.

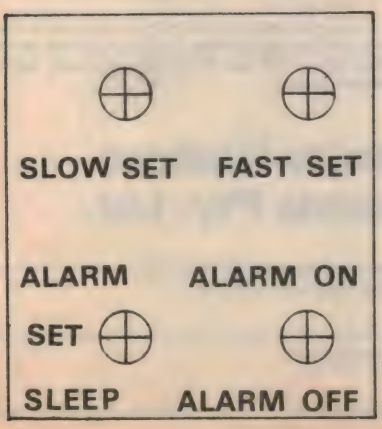
We fashioned a touch plate from three stout pieces of tinned copper wire, fashioned into long staple-like shapes. These were clamped across the case, between the side slots at the front of the case, and bent underneath to hold them in position. At one end, they were bent so as to touch, and the lead to the PCB soldered on. Refer to the accompanying photographs for more details.

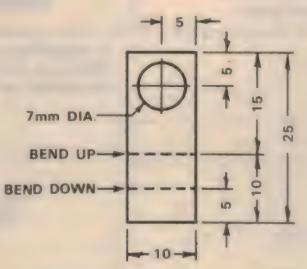
We have not shown any mounting details for the radio, as we felt that this was best left up to the individual constructor. One possibility, however, is to simply mount the radio on top of the clock, so that all controls are still accessible.

We have designed two front panels for the clock, one for use with the basic version, and one for use with the more advanced version. Both these are reproduced full size with this article, and they should also be available from the usual metalwork suppliers as well.

We have been advised by National Semiconductor that some of the latest modules which have been imported are supplied without heatsinks on the power transistor. This is no cause for alarm (sorry!) however, as the heatsink is apparently only required in conditions of high ambient temperature and display brightness. If desired, a small heatsink could be fashioned from aluminium, and added to the transistor.

Type B clock modules, transformers and associated parts are available from Radio Despatch Service, 869 George Street, Sydney, and from Techni-Parts, Woolworths Arcade, 95 Latrobe Terrace, Paddington (Qld.) 4064. This latter firm also has type D, F and H modules, in small quantities only, and earphone transducers available.





Above: the metalwork diagram for the two metal brackets. Make two from scrap aluminium. At left is an actual size reproduction of the rear panel labelling (feature clock only).

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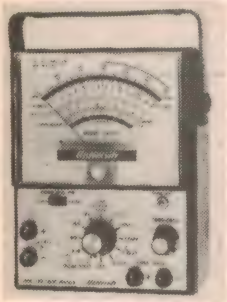

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Auto Rhythm Unit For Electronic Organs

In the previous article in this series, we gave details of how to use the M252 rhythm generator chip. This month we give details of the S8890 chip from American Micro-systems, and how to use it with the instrument generator board.

by DAVID EDWARDS

The S8890 rhythm generator is a counter-ROM specifically designed for electronic organs and other electronic instruments. It is supplied in a 40 pin DIL ceramic package, and contains an internal oscillator, a 6 bit counter, and a ROM that drives eight instruments, as well as a seven-segment sequence count display.

The S8890 chip is obtainable from Cema Distributors Pty Ltd, 21 Chandos Street, Crows Nest NSW 2065. Your usual component supplier should be able to obtain it for you.

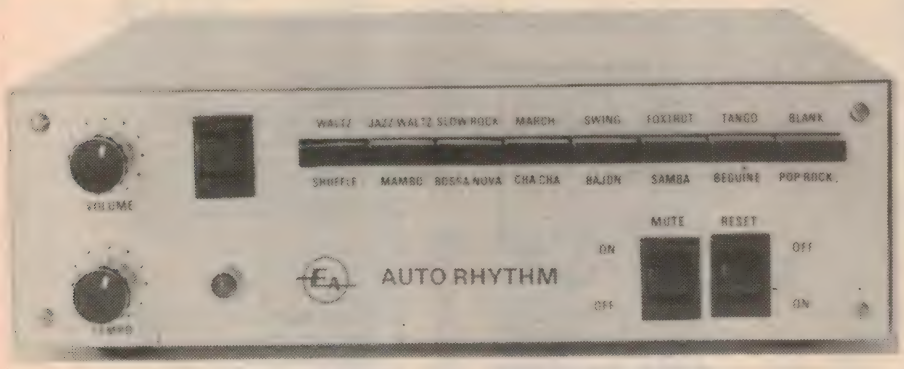
The oscillator frequency is determined by an external network, and requires the addition of only a PNP transistor, two capacitors and three resistors. The 6 bit counter has inputs that allow the counter to be reset at any one of five counts. The 64th count is normally programmed as the fifth reset option.

The counter contains a start input that holds the system in the reset mode until a start command is impressed. The counter outputs drive a 64 word ROM, which has eight rhythm instrument outputs, a downbeat output, and a rhythm count output.

The downbeat output is programmed to provide an output at the beginning of each measure. The eight instrument outputs each contain 10 rhythm patterns which may be simultaneously selected to overlay multiple rhythm patterns.

The rhythm count outputs provide a seven segment code that can be used as a visual display of musical timing. We have not included this feature in our rhythm generator, as we felt that it was not essential to the production of rhythms. Information on how to use this feature can be obtained from the S8890 data sheet.

Turning now to the circuit diagram, we can discuss the various features of the circuit. As before, a buffer is required for the power supply from the instrument generator board. This has been implemented in an identical manner, and need not be discussed here.



The completed prototype provides for some fifteen different rhythms.

The oscillator is formed by the second PNP transistor and its associated components. The 22uF tantalum capacitor is charged via the 22k tempo control and the associated 1k stopper resistor. The capacitor voltage is monitored by pin 16, and when this exceeds an internal threshold, pin 17 turns on the transistor, which discharges the capacitor. The cycle then repeats.

Pin 18 is connected to the +30V rail via the reset switch. This resets the counter, which commences from the start of the program when the reset switch is released.

The downbeat output is connected directly to the downbeat input of the instrument generator board. This must be wired to accept positive edge triggering. The downbeat LED will then operate at the start of every measure.

The eight instrument outputs are also connected directly to the inputs of the instrument generator board. Since the outputs consist of a single transistor connected to the +30V rail, it is not necessary to use the input diodes of the instrument generator. These may be replaced with links.

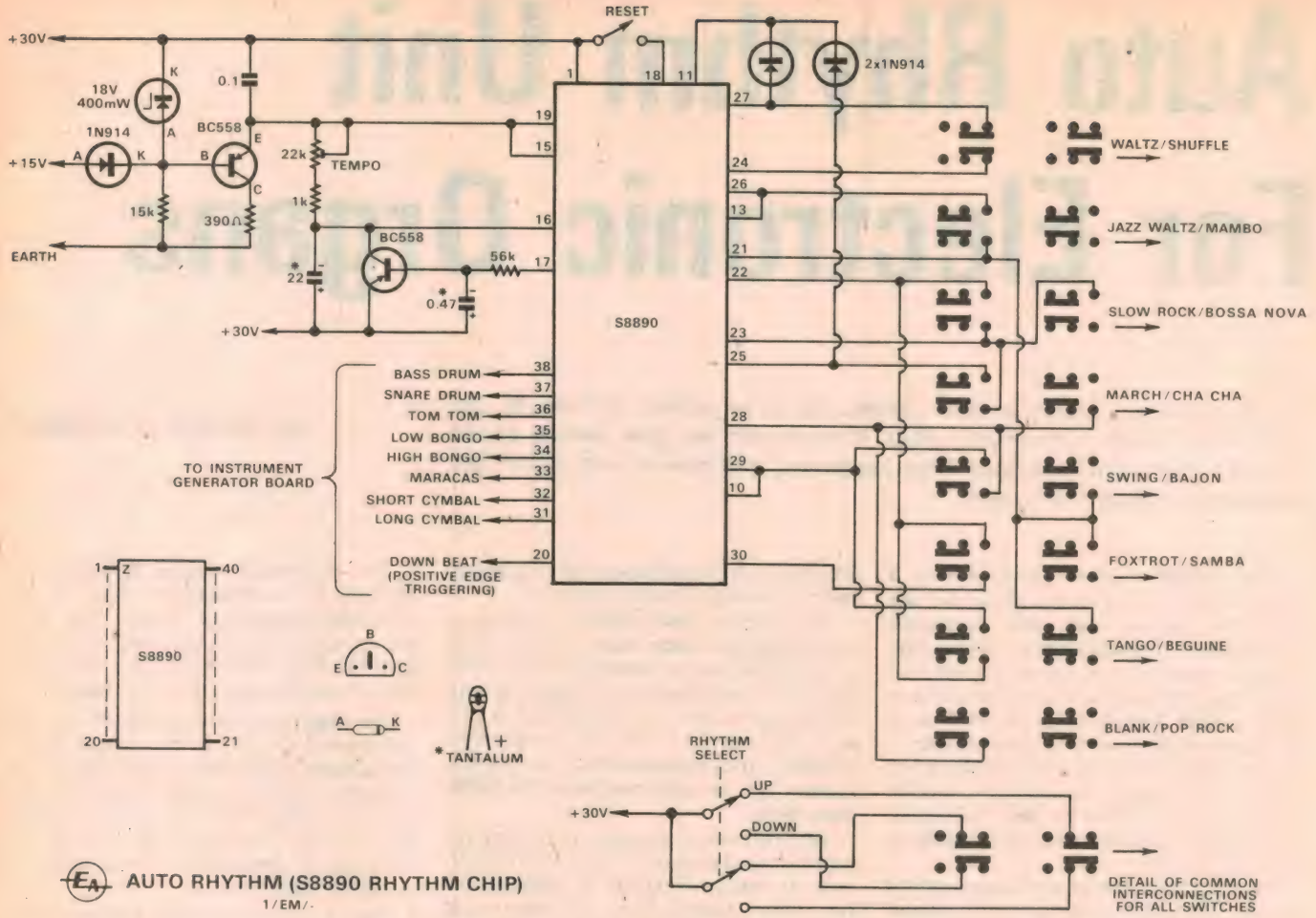
Pins 21 to 30 are the rhythm select inputs. Pins 10, 11 and 13 must be connected to pins 25, 26, 27 and 29 as shown. These latter pins are the count reset inputs, and are used to reset four of the rhythms at counts which are less than the maximum count.

The two diodes are necessary to prevent interaction between the two rhythm select inputs which are connected to pin 11. As stated earlier, only ten separate rhythms can be obtained from the S8890 device, but more than one of these rhythms may be selected at once.

We have used the same switch as specified in last month's article, but have re-arranged the wiring to suit the S8890. The ten individual rhythms which are selectable are as follows: waltz – shuffle – jazz waltz – mambo – bossa nova – march – swing – samba – beguine – pop rock.

As before, the blank position does not produce any rhythm at all. The remaining five switch positions have been filled up by combinations of the other ten rhythms. For example, slow rock selects both beguine and bossa nova.

In this diagram we have not shown the output circuitry from the instrument simulator board, because this is the same as shown in last month's article. But to aid construction, we have reproduced in this article the Veroboard rhythm chip wiring layout that we used for our proto-



AUTO RHYTHM (S8890 RHYTHM CHIP)

1/EM/-

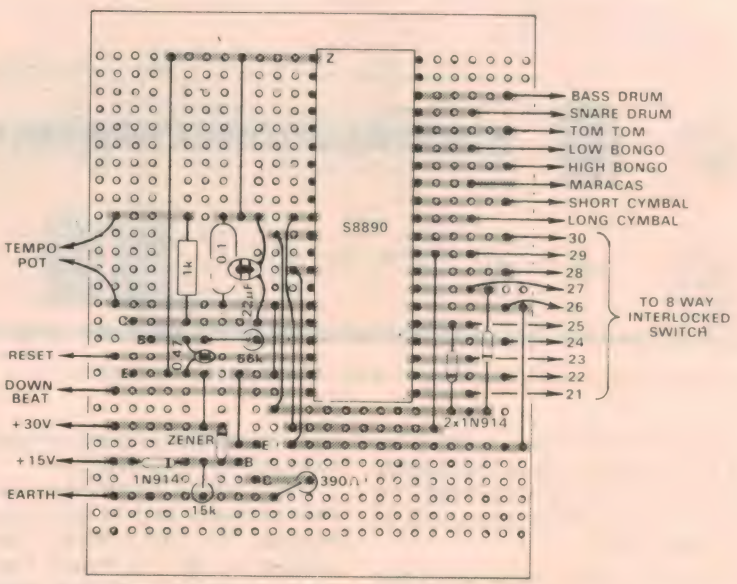
type. This board will be a drop-in replacement for the Veroboard used in the previous article.

The S8890 is susceptible to damage from static charges, and we recommend that it be mounted in a socket. All the wiring to the instrument simulator board, and the placing of the components on the Veroboard can be carried out before inserting the S8890 in the socket.

The circuit diagram shows a schematic representation of the wiring for the interlocked switches. This can be used as a guide for wiring the switches. First make all the connections to the centre posts (shown on the diagram as the common connections), and then complete the remaining wiring on the switches. Lastly, add the eleven wires connecting the switch bank to the remainder of the circuit.

Readers are referred to the previous articles for details on a suitable case, front panel, and component layout. The parts list included with this article should be read in conjunction with the one presented in the October 1976 issue.

Once construction is complete, the unit can be tested. Apply power, and check the operation of all switches and controls. It may be necessary to adjust the trimpots on the instrument board to achieve suitable sounding instruments. Follow the instructions given in the October article for this.



The circuit diagram at top shows how the S8890 rhythm chip is interfaced to the player and to the instrument simulator board. Above is a component overlay pattern for making the circuit up on a small piece of Veroboard.

As before, we found that it was necessary to change one resistor on the instrument board to achieve a more realistic sound balance. We altered the 1M resistor connected to the 0.1uF capacitor at the input of amplifier B2 to 100k. Note that we did not alter the feedback resistor, but the resistor connected to the FET source.

In order to give an improved sound when rapid tempos are used, we found it advantageous to alter the time constants of the white noise derived

instruments. This can be achieved in several ways.

The time constants of each of the final R/C combinations connected to the FET gates must be reduced in value by a factor of about four. This is done by reducing either the resistor or capacitor values.

Economically, the best solution is to reduce the capacitors, from 0.47uF to 0.1uF, and from 0.22uF to 0.047uF. However, if you have already purchased these capacitors, then it may be cheaper to replace each of the trimpots with suitably lower values.

PARTS LIST

1 S8890 rhythm generator chip
2 BC558 PNP transistors
1 18V 400mW zener diode
3 1N914 silicon diodes
1 22uF tantalum electrolytic capacitor
1 0.47uF tantalum electrolytic capacitor
3 0.1uF plastic capacitors
1 390 ohm, 1 1k, 1 15k, 1 56k ¼W resist ors
1 22k linear potentiometer
1 47k dual log. potentiometer
3 NKK DPDT toggle switches, part No. SP2022
3 NKK bezels to suit, black, part No. AT-205
1 Schadow 8-way 4-pole interlocked push button switch, part No. TS-539

MISCELLANEOUS
2 Knobs
1 case, 230 x 205 x 68 mm
1 front panel to suit, see text
1 PL24/20VA 24V transformer, or equivalent
1 piece Veroboard (1/10" spacing)
1 output connector
Solder, hookup wire, rainbow cable, shielded cable, PCB standoffs, rubber feet

Note: resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may be used in some cases, providing ratings are not exceeded.

Reduce the 2.2M trimpots to 470k, and the 1M one to 220k. A third alternative, which is cheaper but less desirable, is to simply add extra resistors in parallel with the existing trimpots, on the underside of the board.

We have been unable to present details of how to use the S2566/S2567 combination rhythm generator chips, as we were unable to obtain sufficient data about these devices in time to meet the deadline for this article. The lack of a sample of the M253 device has also prevented us from supplying details of how this device can be used.

A practical, down-to-earth introduction to

Op-Amps without tears-1

Here is the first of a short series of articles which provide a practical, down-to-earth introduction to modern operational amplifiers and their applications. If you're still not too familiar with these powerful little devices, it should make rewarding reading.

by J. BRIAN DANCE, M.SC

The operational amplifier is the most important basic building block of all linear circuits. It has a wide array of applications in such fields as audio power amplifiers, timers, voltage regulators, sensitive measuring circuits, etc. This series of articles will provide readers with a basic understanding of the operation of these units (even if they have had no previous experience whatsoever). The basic principles will be covered in the early parts, but the emphasis will be on the practical use of the devices in circuits rather than on the internal circuitry of the devices used.

THE BASIC AMPLIFIER

The term 'operational amplifier' was originally applied to high gain amplifiers operating down to zero frequency which were used in analog computers to perform certain mathematical operations (including addition, subtraction, integration, etc). These high gain amplifiers are now used for a wide variety of applications, but the name "operational amplifier" or "op amp" is normally used even though no mathematical operations are involved.

The early operational amplifiers employed discrete components, but it is now much more convenient to employ an integrated circuit. Instead of making up a circuit containing perhaps a hundred discrete components, one uses a small integrated circuit together with perhaps half a dozen external components. The integrated circuit or IC contains a large number of individual components all formed on a miniature silicon chip. All of the connections between the internal components are automatically made by photographic techniques during the manufacture of the IC.

One of the main advantages one obtains from the use of integrated circuits is the saving in time wiring up numerous connections, but an additional advantage is that the internal connections are much less likely to fail during use than connections made by a soldering iron. One also saves a great deal of space and weight by the use of integrated circuits instead of discrete components.

Another advantage of using integrated circuits is that the cost of most of the commonly used devices is far less than the total cost of the components in an equivalent circuit using discrete components. Indeed, some modern integrated circuits containing many transistors are priced at a value only two or three times the cost of a cheap transistor.

A minor disadvantage of an integrated circuit is that one cannot make any changes to the internal circuit contained in the device, since the components are fabricated on a monolithic silicon chip which must be carefully sealed against the moisture and other substances in the atmosphere.

Integrated circuit operational amplifiers are best regarded as building blocks which can be used to assemble more complex circuits. These devices are now so convenient to use that very few people even consider the construction of a complete discrete amplifier unless there are special circuit requirements.

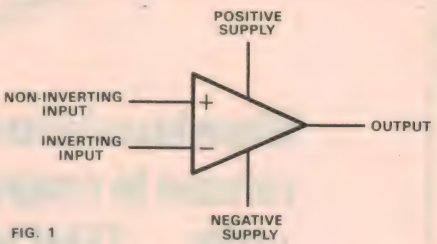


FIG. 1

The circuit designer is not generally interested in the internal components of an integrated circuit, but only in the performance of the unit as a whole. One therefore uses the amplifier symbol in Fig. 1 to denote the amplifier. It can be seen that there are two inputs, one output and connections to the positive and negative supply lines.

If one makes the inverting input slightly more positive, the output will become more negative; this is why the name 'inverting' is given to this input. If, however, the non-inverting input is made more positive, the output will also become more positive.

THE 741

We shall start our discussion with special reference to the 741 device, since it is one of the best known general purpose operational amplifiers and is readily available from almost all of the large semiconductor manufacturers. If is also one of the cheapest of all linear integrated circuits.

The user meets only the external circuit, so one of the first questions the newcomer to electronics will ask is "What does a 741 device look like?". The device is actually available in a number of different packages, some of which are shown in Figs. 2 to 4, with connections.

Readers will usually find the type of 741 shown in Fig. 2 the most convenient to use; it is also normally the cheapest. This type of package is known as the 8 pin dual-in-line, since there are four pins on each side of the body of the device and, when viewed from one end, these pins form two lines of four pins per line.

The triangular symbol for an amplifier is drawn on the body of the device in Fig. 2 for clarity. As in all dual-in-line integrated circuits, there is either a small notch between pins 1 and 8 or a small circle near to pin 1 which identifies the end of the device near to pin 1. The user must be careful that the device is used the correct way around and it is only these small marks which provide this information.

An electrically similar 741 device can also be obtained in the 14 pin dual-in-line package shown in Fig. 3. Yet a further type is in the circular metal "TO-5" transistor-type package of Fig. 4. Other more expensive packages are available,

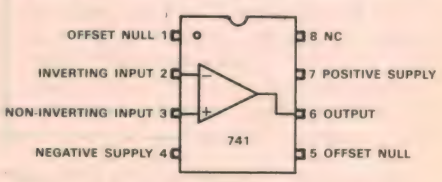


FIG. 2

but the cheapest ones are usually adequate for most of the non-professional requirements.

SOCKETS

One can solder connections directly to the 741 pins or one may solder connections to a suitable socket and insert the 741 in the socket. Dual-in-line sockets for the packages shown in Figs. 2 and 3 are readily available, but may cost even more than the device itself. Readers may therefore prefer not to employ a socket, but one should remember that it is much

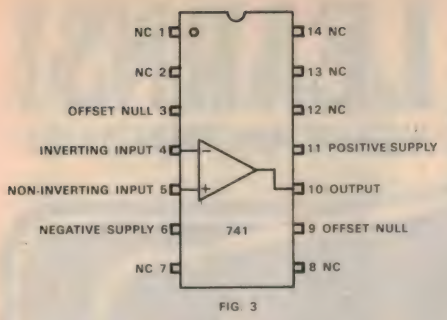


FIG. 3

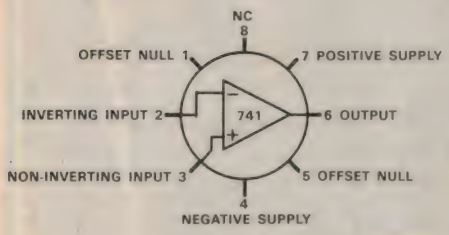


FIG. 4

easier to change a device suspected of being faulty if one has used a socket. Sockets are probably more attractive with more expensive devices than the 741. To remove a device from a socket, always slip a screwdriver blade under the body of the device.

EXPERIMENT!

One of the best ways of learning about any electronic device is to experiment with it in simple circuits. This is especially true in the case of operational amplifiers. The circuit of Fig. 5 can be used to enable the inexperienced reader to become familiar with the 741 device.

It should be noted that positive and negative power supplies are usually used with the 741. In this circuit ±9V supplies are shown, since readers can easily obtain these by using two small batteries. The supplies may be ±15V if larger output voltages are required but they must never exceed ±18V with most 741 devices.

The pin connections shown in Fig. 5 are applicable only in the case of the 8 pin dual-in-line device of Fig. 2 or of the circular metal package of Fig. 4. The connections for the 14 pin dual-in-line package are quite different, as shown in Fig. 3. It should be noted that the +9V supply is fed to pin 7 and the −9V supply to pin 4. The non-inverting input at pin 3 is conventionally marked '+' and the inverting input at pin 2 '−', but these are NOT the positive and negative power supply connections. The capacitors C1 and C2 may be required to prevent instability if the power supply connections are long, but one can often omit these capacitors without any troubles arising.

The voltmeter is connected to the output so that one can measure how the output voltage from the 741 varies as the input voltages are changed. This meter should have a full scale deflection of about 10V, but a centre reading meter (10V-0-10V) would be ideal. One can, of course, make a suitable voltmeter by connecting a 100uA meter in series with a 100kilohm resistor or a 1mA meter in series with a 10kilohm resistor or some similar combination.

OFFSET NULLING

The preset variable resistor VR3 is included so that one can trim the circuit so that the output voltage is zero when the voltage at both of the inputs is zero. This process is known as offset null adjustment. Connect both pins 2 and 3 to ground and adjust VR3 for zero output voltage. Note that the adjustment is quite critical. As the device warms up, the output voltage drifts off the zero, but it can be returned to zero by adjusting VR3 again.

This drift of the output voltage with temperature can be important when one is using the amplifier at high gain. There is no feedback in the Fig. 5 circuit, so the amplifier is operating at maximum gain where the drift with temperature is worst. Indeed, this drift is one of the reasons why operational amplifiers are not normally used in this way.

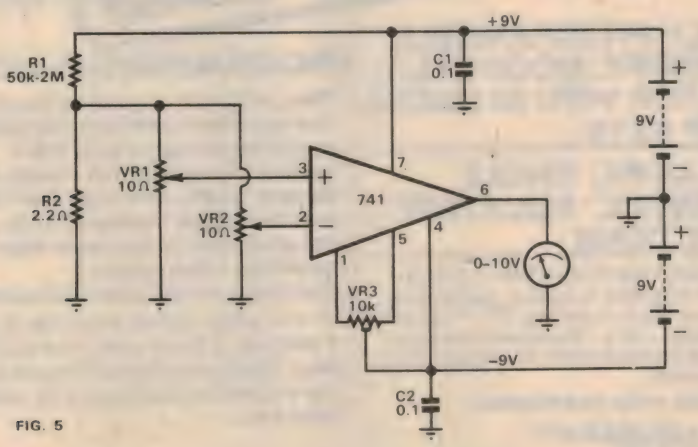


FIG. 5

GAIN

The gain of an operational amplifier is generally extremely high, but varies considerably from one device to another. For example, the gain of the 741 at zero frequency is quoted as being typically 200,000 in most manufacturers' data sheets, with a minimum for any one device of 20,000 or 25,000 and no maximum value quoted.

One can make an estimate of the zero frequency gain of a 741 device using the

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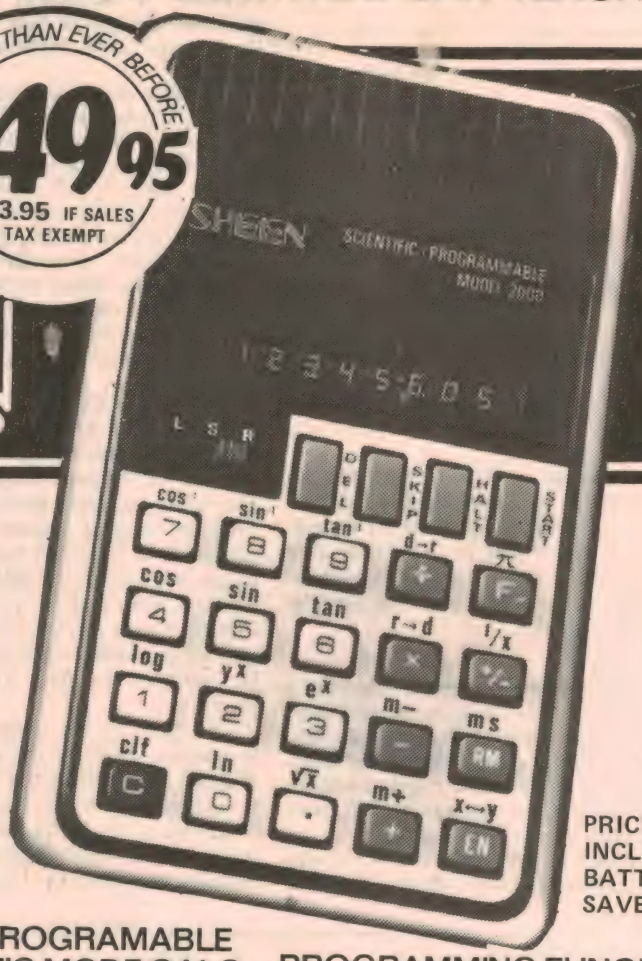

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input circuit shown in Fig. 5. The value of R1 should be about 50 kilohm when the 741 has a gain near to the minimum value of 20,000 but a value of 2 megohm is more suitable for 741 devices which have a high gain. When R1 has a value of 50 kilohm, the potential at the junction of R1 and R2 will be about 400uV; if this is amplified 20,000 times, one obtains a convenient reading of about 8V on the output meter. If, however, R1 has a value of 2 megohm, the junction of R1 and R2 will have a potential of about 9uV; this is suitable for use with a device of a gain of nearly one million to produce a suitable output voltage reading.

A value of about 500 kilohm may be tried initially for R1. After setting the offset null voltage to zero at the output, leave the inverting input grounded and move VR1 so that the non-inverting input is connected to the potential at the junction of R1 and R2. If the voltage reading at the output is too small to be conveniently read, decrease R1, whilst if the reading is above 7V R1 should be increased.

When a suitable value of R1 has been found, note the change in the output voltage reading as the non-inverting input is moved from ground potential to the junction of R1 and R2 by means of VR1, VR2 remaining at ground potential throughout. The voltage gain is equal to this change in output potential divided by the change in the non-inverting input potential, the latter being approximately equal to R2/R1 multiplied by 9V.

Note that as the potential of the non-inverting input is increased slightly, the

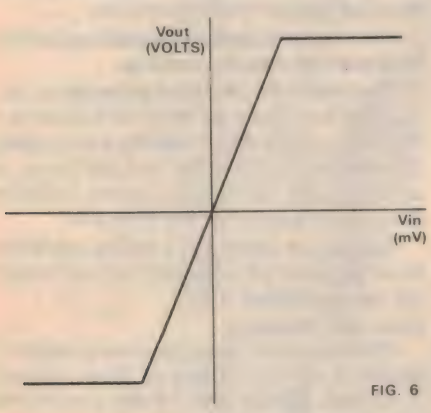

FIG. 6

output voltage increases, whereas an increase of the inverting input potential will result in a decrease in the output voltage. If the sliders of both VR1 and VR2 are moved from the lowest (ground) potential to the highest potential (at the junction of R1 and R2), the output voltage will show little change, since the increase in potential of the one input is almost exactly balanced by the increase in potential of the other input. Thus the circuit is essentially sensitive to the difference between the potentials of the two inputs.

If one keeps the inverting input potential at ground and varies the non-inverting input voltage by VR1, the output voltage varies as shown in Fig. 6. It should be noted that the maximum possible swing of the output voltage is about 1V less than the potential of either supply line—hence the horizontal parts of the graph of Fig. 6.

AC GAIN

If an audio signal generator and either an oscilloscope or an AC voltmeter is available, the gain of a 741 device can be measured at various frequencies. A suitable circuit is shown in Fig. 7, the offset nulling potentiometer being unnecessary in this application. The output voltage can be measured by means of an oscilloscope or a suitable AC voltmeter, care being taken that the input is not so high that the output approaches the horizontal parts of the Fig. 6 graph. The alternating input voltage is best measured by connecting the oscilloscope or AC voltmeter across the audio generator and dividing by the ratio R1/R2.

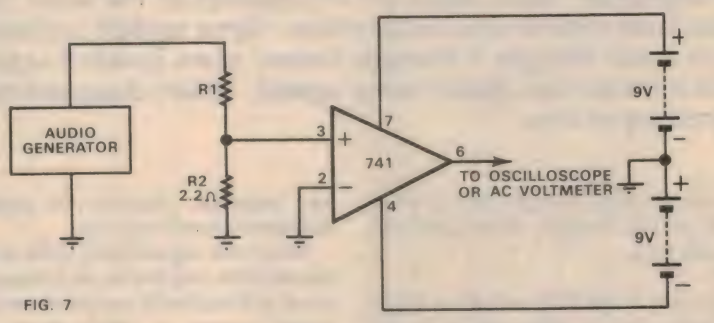

FIG. 7

Thus the gain of the amplifier can be found by simply dividing the alternating output voltage by the alternating input voltage. It will be found that the gain of a 741 device falls off quite rapidly at frequencies above about 5Hz; this variation of gain with frequency is shown in Fig. 8 for a typical 741 device. It may be noted that the gain falls to zero at a frequency of the order of 1MHz.

The bandwidth of the amplifier is normally taken as the frequency at which the gain has fallen by 3dB. This is the frequency at which the output voltage has fallen to $1/\sqrt{2}$ or 0.707 of its gain at very low frequencies. The experiment may be repeated with inputs 2 and 3 interchanged in order to check that the gain falls off in a similar way with frequency when the signal is fed to the inverting input.

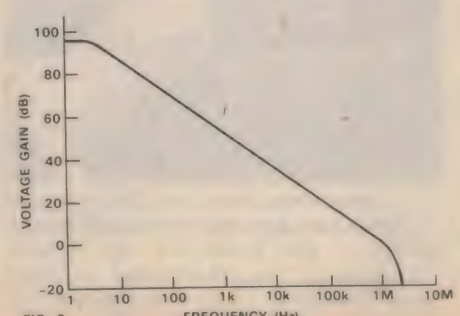

FIG. 8

FEEDBACK

We have seen that the 741 device offers a very high gain at low frequencies. However, this gain varies so much from device to device that we could not even specify definite values of the resistor R1 in Figs. 5 and 7. The gain falls off above about 5Hz at approximately 20dB for each factor of ten increase in frequency and the quiescent output voltage varies widely even with small temperature changes.

The reader may well question whether a device with so many disadvantages is likely to be of any practical use. We shall see in the next article that the answer to these problems lies in the use of negative feedback. Such feedback does reduce the gain, but it can allow the gain to become dependent only on the values of two external resistors, so that variations from device to device have a negligible effect on the performance. The gain can be made constant up to much higher frequencies than 5Hz, but it inevitably falls at some value of frequency and continues to fall as the frequency is further increased. The offset voltage still exists, but with a circuit of lower gain the drift of the output voltage becomes tolerable for most applications.

Operational amplifiers are rarely used in practice without negative feedback. The problems we have encountered are just unacceptable in almost all applications. However, we have not wasted our time looking at circuits without feedback, since the understanding we have gained will help us when using the devices. We are now aware of many of their limitations.

The gain we have been measuring is known as the "open loop" gain, since it is the gain measured with the feedback loop "open" (that is, with no feedback).

(To be continued.)

Forum

Conducted by Neville Williams

Is 2-channel stereo the pure system?

As usually happens when an audio subject is brought up, our discussion in the September issue about the implications of the word "stereo" attracted more than its share of attention. Some readers confessed that they had never thought it through before; some couldn't understand what all the fuss was about; some agreed, others disagreed with the various points of view.

From across the Tasman came a letter from F.S. of Papatoetoe, New Zealand, who writes thus:

Dear Sir,

Do you not think that you have been rather harsh on R.P. who seems to ask a reasonable question regarding the technical aspects of stereo? While the article's contents are of interest on the broad subject, it does not seem to contradict or comment on R.P.'s statement: "It is fundamental that there be two effective channels right through the chain for all sounds".

Is this statement correct?

In supporting the use of multiple mono recordings to build up a stereo record, you imply that it is not correct but I think readers are entitled to a clearer explanation.

Have you ever made a direct comparison between recordings of, for example, two instrumentalists some distance apart with individual microphones, and two instrumentalists together with a Blumlein pair?

First let me say that, if guilty of treating R.P. harshly, I am more than ready to apologise. We certainly do not seek to take unkind advantage of readers who, in all good faith, raise matters for discussion in these columns.

Of course, if a correspondent obviously wants to "have a go", we may tend to reply in kind, but there was no such suggestion in R.P's letter or, I hope, in our reply.

However we—or I—clearly stand accused of not being sufficiently explicit; of making the discussion so wide ranging that the key question was answered by implication rather than in so many words. Rather than becoming involved in semantics, let me spell out the answer right here:

Most definitely, normal domestic stereo relies on signal information from two separate channels to position the apparent sound sources.

When the signal from both channels is identical in amplitude and phase, the listener will normally perceive an apparent sound source at centre front, indistinguishable in itself from a mono source. If the relative balance between the signals is changed, the source will move to left or right, just as if it were being reproduced in the new position by a single loudspeaker. In fact one of the criteria for judging a stereo system is its ability to create "firm" mono images

When handling typical program material, the balance between channels varies subtly for each individual sound source so that, at the listening end, virtual point-source images are spread across the listening "sound stage". In other words, the two channels should interact to produce a multiplicity of virtual sound sources, one for each point source in the performing group, one for each pipe in a grand organ, and so on.

Is this the microphone hifi purists should really be backing—the tetrahedral design which is the basis for the British "Ambisonic" multi-channel system? (IMF Products, G.B., Westbourne St, High Wycombe, Bucks, England.)

Superficially, therefore, I agree with R.P's statement that there must be "two effective channels right through the chain for all sounds". It's a basic requirement for any 2-channel stereo system. But I didn't go along with the way he interpreted the statement!

He spoke derisively about "two-channel mono", as if the term itself carried its own condemnation; in fact, any ordinary stereo system relies ultimately on two channels, both of them mono!

He criticised, by inference, "an impression of lateral dispersion", which is precisely what any 2-channel stereo system gives: not multiple sound sources, but an impression of multiple sound sources!

In short, I feel that R.P. tended to justify a perfectly legitimate point of view on questionable grounds. If he had said "I prefer an occasion-orientated, or performance-orientated recording, made with a pair of microphones substituting for the listener's ears", there could have been little ground for argument. It would be a value judgment shared by a very large number of people—and particularly those interested in classical music.

But when he tried to make capital out of distinctions between stereo and 2 two-channel mono, between stereo and impressions of lateral spread, and the rewarding or wasteful use of two channels, he was providing would-be opponents with ready-made ammunition.

F.S. asks whether I personally have put these theories to the test, presumably with the objective of arriving at an unambiguous yes-no kind of answer.

No I haven't, and I wouldn't expect to find such an answer anyway.

The whole thrust of the September discussion was towards the conclusion that the way you go about making a recording depends on partly what you are trying to achieve, and partly also on the facilities you can organise for the purpose.

And so we come a to a follow-up letter from the man who started it all; or should we say re-started it all:

Dear Mr. Williams,

Thank you for your interesting reply to my letter on the subject of stereo sound. It wound appear that I have stimulated a very sensitive nerve.

Firstly, if you care to re-read my letter, at no time did I specify the form of transducer to be used to recover the electronically recorded sound; only that the said recording be of such a nature that, given the requisite condition, a pure stereo signal would be available.

The fact that, at the present time, it is not possible to reproduce it fully in the home environment is rather irrelevant. Since the earliest days of sound broadcasting, the vast majority of radio stations

have maintained a quality of transmission far exceeding that of any known method of reproduction at the same period of time by several orders of magnitude. This has, in no way, deterred them from pursuing this policy.

For exactly the same reasons, I consider it to be wrong not to provide a genuine stereo signal on any recording. Synthetic stereo may be desirable commercially but doubtful technically.

We know it is physically impossible to have a full orchestra in the lounge room and mentally dismiss this, but why must we add yet another paradox: something we cannot hear in real life?

With improvements in speaker technology we are getting closer to the goal of a really low distortion system. If really low overall distortion eventuates, some of today's artistic performances may be compromised for posterity, as were those of earlier times, due to the physical limitations in recording.

You will note that I have not considered the degree of hirsuteness, nor can I question the undesirability of a plank suspended above the conductor supporting an assortment of posteriors.

The relevant merits of different styles of music were also not raised by me, so it would be impossible to classify me on this point, unless we are in agreement that nothing anyone can do will make the present pop sound any worse than it already is!

I thank you for your kind description of me as a hard liner. At least you have placed me on the fringe of many distinguished pioneers of hifi, all trying to improve the quality of sound reproduction. After 44 years of professional involvement in sound reproduction, I still believe the right way is still the best way, providing it complies with technical requirements.

R.P. (Parkdale, Vic)

First let me assure R.P. that, if any sensitive nerve was affected, it wasn't mine. I hold no special brief for the multi-mic technique or any of the other matters raised in the September issue. As I pointed out in the particular issue, the letter epitomised arguments that have been going on for a very long time and I sought to react to the letter, not in isolation, but in the context of all those decades of discussion.

Nothing that R.P. says in this second letter alters his position as a spokesman for a particular—and legitimate—point of view. What he is at pains to stress is that he wants to rise above lesser things and to uphold the principle of making all stereo recordings in the "right" way, for the sake of future generations.

As a grand principle, it sounds very impressive but I really wonder whether R.P's "true stereo" has the intrinsic technical merit to live up to it.

As a system, it can capture only a limited frontal, lateral spread; it cannot define elevation nor can it isolate and

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- FULL WARRANTY · PUSH
- TO TALK MIKE
- POST & PACK $2.00

UTAC 5 watt am

Made by **TOKAI** branded **UTAC**

This is a handsome chunky 5 watt made for the American CB market with the full compliment of 23 American channels. You couldn't buy the bits for this sort of money. So get one while stocks last

- 31 Semiconductors
- All metal case
- Fully synthesised
- P/T/T mike
- Cradle mounting
- 12 Volt DC
- PUB ADD FAC
- P & P $3.00

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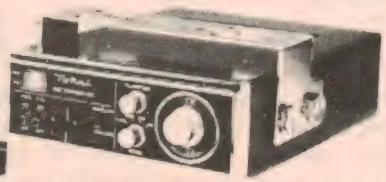
SSB·AM 15 WATT P.E.P. TOKAI



$229 P+P $3

This is the pride of our range of **TOKAI** Transceivers. Everyone wants to own this, but it's not cheap. How can it be with 81 semiconductors including F.E.T.'s. A magnificent sturdy metal case and all the goodies in the way of controls and facilities.

- 5 Watt AM—15W SSB
- Triple AM & Dual SSB Conversion
- AM. USB. LSB. & PUB. ADD.
- P & P $3.00

MOBILE SSB AM

Mobile Transceiver for 12 to 16 Volts D.C. Fully synthesized on all 23 U.S. C.B. Channels

Output: A.M. 4 Watts, S.S.B. 12 Watts { (not input to final)

Dual Conversion: P.E.P. Receiver: Power and S Meter.

Sensitivity: less than .5 uv for 10db. **Transistors:** 36.

Thermistor 41 for use with Novice License.

$199 P+P $3

Ground Plane Antennae

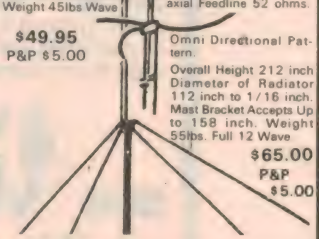
27MC 36

High Efficiency Ground Plane Antenna for CB base station. All aluminium construction. Accepts PL 259 connector. Solid aluminium 108 inch heat treated radials and radiator. Elements supplied in two 54 inch lengths joined by threaded coupling nuts. Radial droop for 50 ohm match. Accepts 114 inch tubing and PL 259 connector.
Frequency Range 27 MHz Impedance 50 ohms VSWR Less than 1.5:1 Weight 4.5lbs Wave 14.

$49.95 P&P $5.00

27MC GPV BASE LOADED

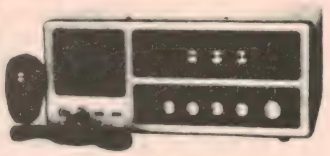
A ruggedly constructed low cost high performance vertically polarized omni directional base station antenna. It develops transmitting gain of 3.8dB through pattern compression and a lowered angle of radiation along with improved signal to noise ratio. The matching stub places it at DC ground potential which substantially lowers the residual noise level and results in gains as high as 19dB in signal to noise ratio.
Gain 3.8dB VSWR (At resonance) 1.25:1 Coaxial Feedline 52 ohms.



Omni Directional Pattern.
Overall Height 21.2 inch Diameter of Radiator 11.2 inch to 1/16 inch. Mast Bracket Accepts Up to 1.58 inch. Weight 5.5lbs. Full 1/2 Wave.

$65.00 P&P $5.00

BASE AM

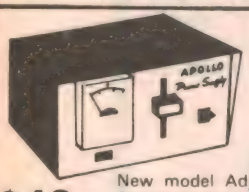


Base Station dual Voltage 240V. AC or 12V. DC. Fully equipped with 23 American C.B. Channels.

Input to final: A.M. 8 Watts min. S.S.B. 25 Watts P.E.P.
Dual conversion: 7 I.F.Ts and 6 I.F. stages
Noise Blanker: Delta tune (Clarifier) +— 300 Hz.
Meter for, Signal in, R.F. out, S.W.R.
Sensitivity: .5 uv @ 6db **Size:** 33 x 13.5 x 24.5 cm.
Wt. 7¾ kg. For use with Novice License.

$249 P+P $5

REGULATED POWER SUPPLIES O—15 VOLT



$42 P+P $2

New model Adjustable Regulated Power Supply Delivers 3 Amps from 0 to 15 Volts Meter shows Voltage and Amps. On/off switch. Perfect where flexibility is required. Ready to wire in.

THE TRANSCEIVERS ADVERTISED HERE ARE BUILT TO AMERICAN F.C.C. SPECIFICATIONS. A NOVICE OR HAM LICENCE IS REQUIRED TO OPERATE SUCH EQUIPMENT IN THIS COUNTRY.

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SAVE $10! ON GUTTER GRIP AERIAL

If you buy any of the above Transceivers you will be eligible to buy one Guttergrip or Roof Mount Aerial—usually **$19.50**—For only **$9.50**. Offer lasts till 30th Dec. 1976 only.

$19.50 P+P $2

WANTED: Real 4-channel stereo

Dear Sir,

I would like to add my thoughts to your article in the September issue of E.A.

From my teenage days in the late 1920's, I have been dabbling with "fi" from very low to reasonably "hi" and this is how I see the scene:

To get the true atmosphere of any performance, whether orchestral, vocal or whatever, the recording must be made in proper 4-channel stereo—not the gimmicky 4-channel stuff.

The right "atmosphere" can only be obtained by a correctly balanced 2-channel performance, with centre phantom channel, in the front, and with genuine ambience effects coming from two rear channels.

If the original performance was before a "live" audience, so much the better, because you would get the sensation of actually being there.

The only true 4-channel stereo recording I have heard, which includes all the ambience sound, is one I made myself featuring Australia's leading military band.

Two good quality studio mics were hung over the band on stage to give left and right frontal sound, the inputs being carefully balanced to give a centre phantom channel. Two "ambience" mics were suspended over the audience, two-thirds of the way to the rear of the hall and 10ft out from the walls.

The ambience mics not only captured the sounds of the band from the walls and rear of the hall but also the audience noise like a baby crying and somebody coughing. And when the audience clapped after each item, it was all around you—just like being there. Maybe not everyone wants to hear babies crying and people coughing, but it goes to show that atmosphere can really be captured.

Fortunately, I have room to reproduce this sound realistically, with a private theatre in my home, 50ft long and 22ft wide. The 4-channel tape, as well as other 4-channel discrete sources, is fed into two high-power amplifiers feeding 8 speakers: 2 in front, 2 at the rear, and 2 along each wall. When played through this system, the band recording is the nearest thing to reality I have yet heard.

It amazes me that, with the advanced technology at our disposal, we haven't had much advance in program sources since the original stereo in the 1950's. I would like to hear a professionally recorded 4-channel stereo featuring proper frontal sound with proper rear ambience. Why don't the record companies get on with true 4-channel stereo tapes? Look at it this way:

Would anyone sooner see a film with just ordinary frontal sound, or a 70mm print featuring 6-track stereo—front speakers and others along each side of the theatre? You are really part of the action. Surely this is what sound is all about.

Please carry on with the good work.

J. D. (Latrobe, Tas.)

define ambience information. There is no reason to believe that future technology will be able to recapture non-existent spatial information from present-day stereo, any more than we can capture non-existent directional information from old-time mono.

If we are going to strive for a "right" way, it should surely be one which seeks to record at least some of these added qualities, which is why I added the lines at the end of the September article " . . . and quite so disdainful of those who are trying to capture and recreate more genuine around-the-listener ambience, with the aid of discrete 4-channel".

Disdainful?

Yes, I used the word quite deliberately, although not with any intention of involving R.P.

But the fact is that many music lovers have become completely conditioned to front-only sound, by decades of listening to ordinary mono and stereo systems. When recording interests try to capture or reconstitute the ambience of an auditorium, they are accused of "gimmickry".

To be sure, quadraphonic recording and reproduction has contained a large element of gimmickry and artificiality but part of the struggle is towards reality, not away from it.

But you just try to convince many dyed-in-the-wool record buyers of that!

Which leads me to the point that work being done in England with the so-called Ambisonic system, and a 4-channel Blumlein-style microphone cluster could be heading towards the kind of "right" basic system that R.P. has in mind. The only trouble is that the idea seems to be spending an inordinately long period in the "boffin" stage.

And that leaves just one thing to do: to read the letter in the panel from J.D. Obviously a hifi fan from way back, he manages, quite spontaneously, to come up with a recipe that variously draws upon and conflicts with, many of the foregoing sentiments:

4-channel stereo—not the synthetic kind—genuine frontal sound with phantom centre channel—dispersed, not cluster, microphones—audience noise, even to crying and coughing. Yet he admits that many would not want that kind of distraction, he rejects the kind of 4-channel material that companies have found it practical to release, and he longs for the kind of open-reel tape that the buying public has virtually rejected.

Is it any wonder that hifi enthusiasts never run out of the will to argue, or the raw material to keep them going!

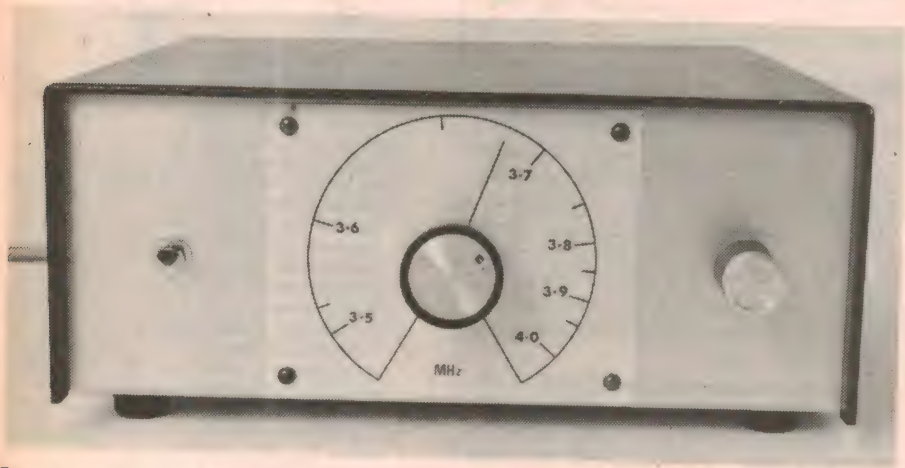
A direct conversion receiver for 3.5MHz

Following on from our recent articles describing transmitting gear mainly intended for the new amateur Novices, we now present a simple receiver for the 3.5MHz band. It uses the ''direct conversion'' principle, and is in fact the first such receiver we have described. It offers good reception of CW and SSB signals using simple circuitry.

by IAN POGSON

Direct conversion receivers have been described in overseas magazines for the past ten years or so, and possibly longer, but we have not entered the field until now. Like most things, there are arguments both for and against.

One of the very favourable points about direct conversion is its relative simplicity. On the other hand, while they are quite good for CW and SSB reception, they are not the best for AM reception. Also, as all or nearly all of the gain is at audio frequencies, problems of hum and instability have to be overcome.



Front panel controls are (left to right) mains on/off, tuning and volume.

However these problems are not insurmountable and direct conversion receivers can give quite a good account of themselves despite the performance limitations.

Before we go any further, I imagine that there are many readers who have not heard of the direct conversion principle. Basically, the wanted signal is first selected by one or more tuned circuits, and may or may not be amplified with an RF amplifier. The signal is then fed into a mixer, together with a local oscillator signal. But in contrast with an ordinary superhet, where the oscillator frequency is offset by the value of the intermediate frequency, here the oscillator is on the same frequency as the signal. This gives a direct audio beat instead of an IF.

Let us take the concept a little further. Suppose that we wish to receive a CW signal. Any input tuned circuits will be tuned to the frequency of the wanted signal and the local oscillator will also be tuned to the frequency of the signal. If the local oscillator is set exactly to the same frequency as the carrier, we will have a "zero beat" condition, with no audio output from the mixer.

Suppose now that we offset the local oscillator (either high or low) from the frequency of the wanted signal by 1kHz. We will now get a beat frequency of 1kHz as output from the mixer. This output will be at low level and must be amplified in an audio amplifier system to drive a pair of headphones or a loudspeaker.

Again, suppose that we wish to receive a single sideband signal. This time, we must adjust the local oscillator frequency as closely as possible to the suppressed carrier frequency of the wanted signal. The sidebands received will now beat with the local oscillator and the mixer output will be the recovered audio of the signal. This needs to be amplified, as explained before.

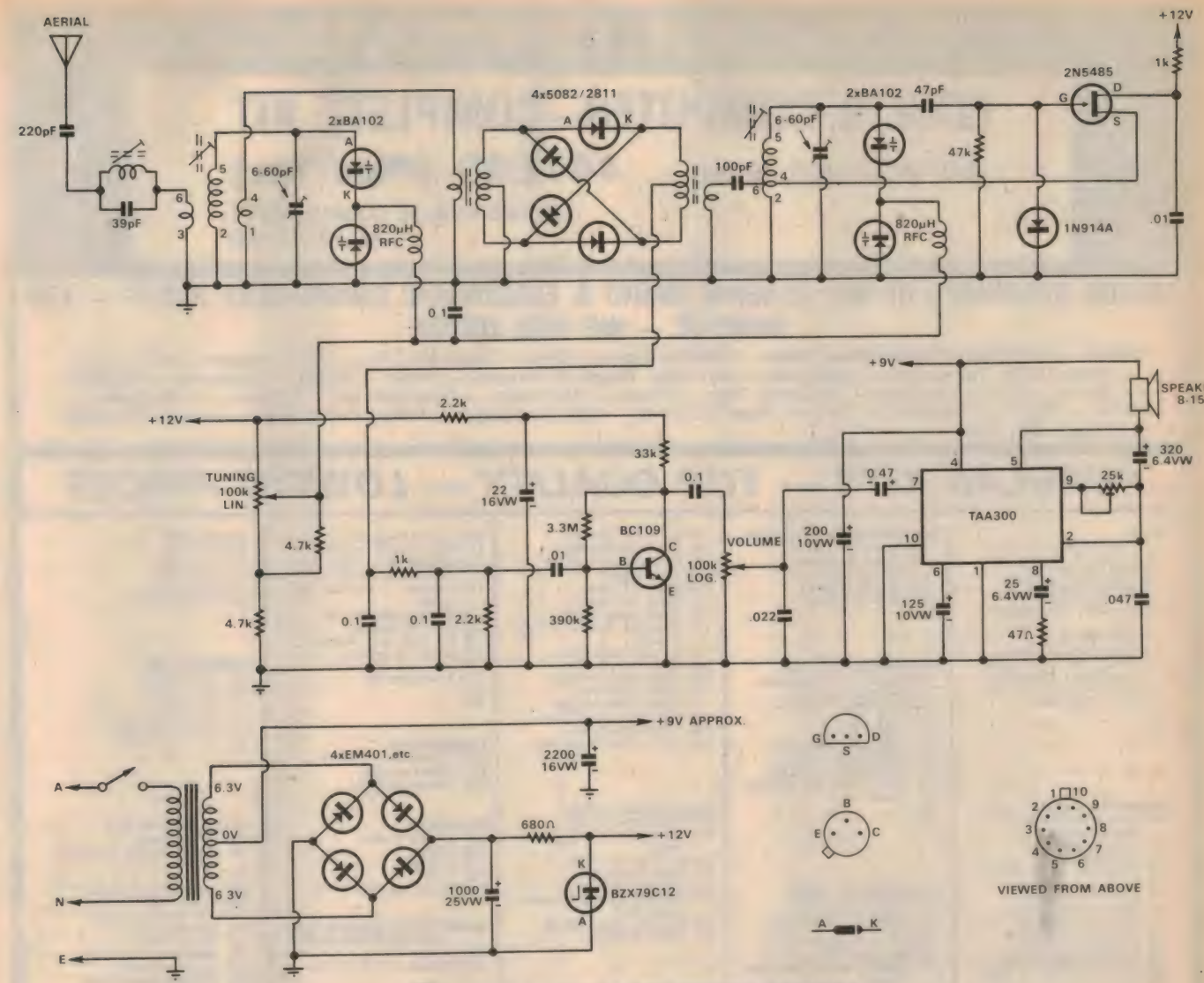
Let us take the explanation a little further and consider the possibility of receiving AM signals. Under these conditions, we must set the local oscillator to precisely the same frequency as the carrier of the incoming signal. This done, we are able to resolve the AM signal quite well. Unfortunately, it is very difficult to meet this stringent requirement. With the local oscillator offset from the incoming carrier, we get a beat frequency equal to the difference between the two. Also, beats against the sidebands are confused and the result is somewhat of a mess.

I have added the last paragraph on the possibility of AM reception so that there is not likely to be any disappointment with the performance of this type of receiver. While capable of resolving CW and SSB signals quite well, direct-conversion receivers are not as good for AM reception.

A look at the circuit will show better how the foregoing has been achieved. From the aerial, the signal is fed into a tuned circuit, consisting of a coil with three windings, one of which is tuned by two variable capacitance diodes, back-to-back. Signals from the tuned circuit are fed into a double-balanced ring mixer.

The mixer consists of two transformers wound on TV "balun" cores, with four hot-carrier diodes. Output from the mixer is from the two transformer centre taps. Injection from the local oscillator is into the second of the two transformers.

The local oscillator is a Hartley, with a junction FET as the active device. The tapped coil is tuned with a pair of variable capacitance diodes, as for the input circuit. A silicon diode between the FET



EA 3.5 MHz DIRECT-CONVERSION RECEIVER

gate and ground is to restrict the amplitude of oscillation.

The tuned circuits are tuned by changing the amount of reverse voltage applied to the variable capacitance diodes. This is achieved by a potentiometer across the regulated 12V supply, the voltage from which is fed to each set of diodes via an RF filter consisting of two RF chokes and a 0.1uF capacitor. The 4.7k resistor on the tuning potentiometer is to assist in reducing cramping at the low frequency end of the dial.

Output from the mixer passes through a low pass R-C filter. The bandwidth of this filter actually determines the selectivity of the system. Consistent with simplicity, the filter constants give a fair degree of selectivity. The selectivity could be narrowed by making a more complex filter but this was considered not to be necessary.

The low level signal from the low pass filter is amplified in a single stage audio preamplifier. A volume control follows, the output of which is fed into a small IC audio amplifier, capable of driving a loudspeaker.

The power supply is a dual arrangement, from a small power transformer with a 12.6V CT secondary winding. Four silicon diodes are connected in a bridge across the transformer secondary. The bridge output gives about 18V DC, which is regulated down to 12V with a resistor and zener diode. Approximately 9V DC is obtained from the transformer centre tap to supply the main audio amplifier.

Before leaving the circuit, you may be wondering why I have not mentioned the 220pF capacitor and the parallel trap circuit between the aerial terminal and the first tuned circuit. The Q of the first tuned circuit is rather low and this lead to a couple of problems. The second harmonic of the oscillator could beat with strong unwanted signals which, although attenuated, came through along with the wanted signals. Of course, the signals were also at twice the frequency of the tuning. As an example, VNG on 7.5MHz could be tuned in at 3.75MHz on the dial.

COIL WINDING DATA

Trap:
50 turns 30B&S enamel close wound on Neosid 7.6mm x 32mm former with grade 900 slug.
Aerial coil:
100 turns 30B&S enamel close wound on Neosid 7.6mm x 58mm former with grade 900 slug. Output winding: 20 turns 30B&S enamel close wound over earthy end of tuned winding. Aerial winding: 10 turns 30B&S enamel close wound over output winding.
Oscillator coil:
100 turns, tapped 20 turns from earthy end, 30B&S enamel close wound on Neosid 7.6mm x 58mm former with grade 900 slug.
Mixer transformers:
Take three lengths 30B&S enamel wire and twist together to a pitch of about 6mm. Wind 15 turns and terminate as shown in diagram.

The trap was added, tuned to 7.5MHz, and this problem was solved.

If you happen to live to close to one or more broadcast transmitters, then there may also be trouble with them breaking through. The 220pF capacitor cures this one.

The problems just mentioned have arisen because the design has been simplified by as much as could be considered practical. Some improvements could be effected by introducing an FET source-follower between the tuned circuit and the input winding of the transformer for the mixer. The low impedance aerial coil winding presently feeding into the mixer would be omitted and the tuned winding itself would be connected to the source-follower, via a blocking capacitor.

By making the above modification, there should be some increase in gain. Also, the Q of the tuned circuit should be improved. However, this is not necessary and the unit as it stands is capable of quite a good performance.

Every effort has been made to be sure that the components used are readily available on the Australian market. However, to make it somewhat easier for the intending builder, a few comments on some of the components may be helpful.

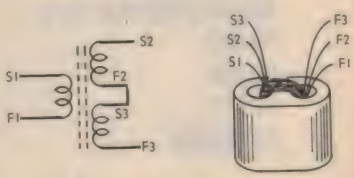
Resistors, capacitors and transistors should present no problems. We understand that there are also ample stocks of the TAA300 audio IC. Diodes for the power supply may be any brand equivalent to the type specified. The variable capacitance diodes are very important though, and the type BA102 must be used.

The hot carrier diodes used in the mixer are ideal for this application and should be used for best results. However, they are rather expensive and if you wish, the gold bonded germanium type OA47 may be worth trying. Even the common OA90 may be satisfactory. However, in the latter case, it may be necessary to increase the value of the 100pF coupling capacitor between the oscillator and the mixer.

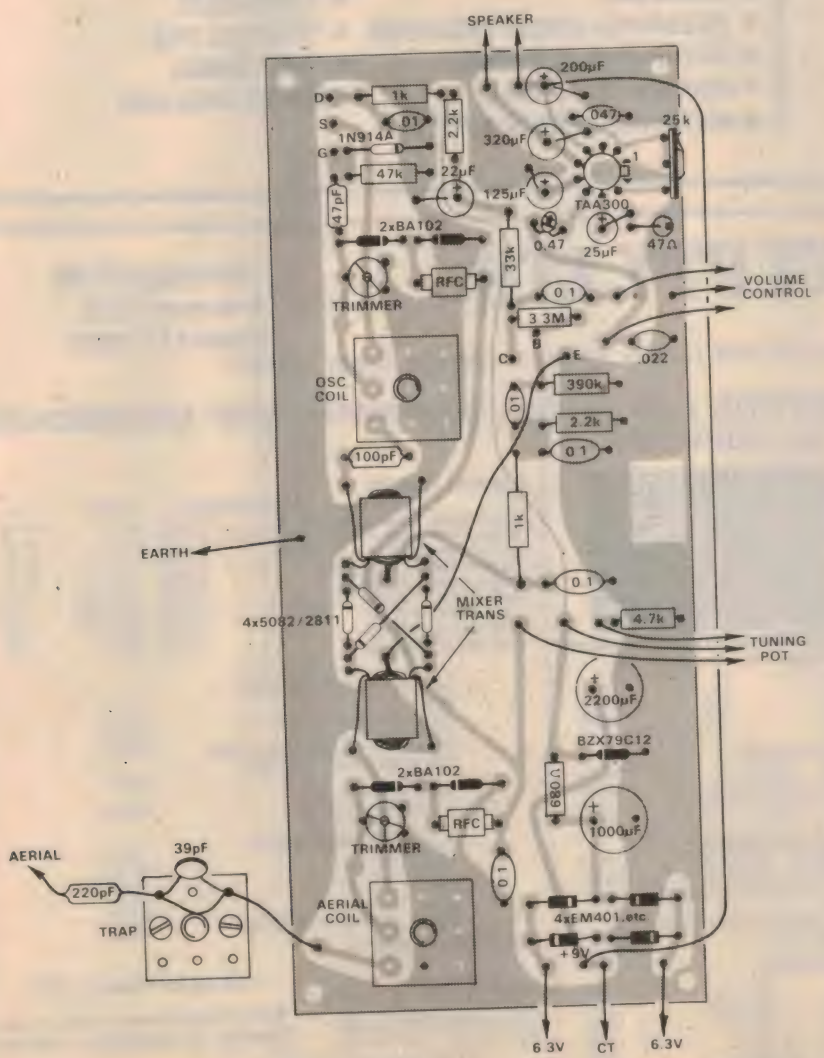
The two RF chokes are not critical and any value between about 330uH and 1mH should be satisfactory. Apart from the coil former for the trap, the other two formers must be the Neosid type specified, as they must fit the printed board. While different types of formers may be satisfactory for the mixer transformers, we suggest that you use those which are normally intended for use on TV baluns.

The transformer which we used is a type PF2851 made by Ferguson. This is a readily available type, rated at 2.5VA. However, there are other similar types available which should be quite satisfactory. These include the newer line now offered by Ferguson, types PL12/5VA and PT12/5VA. If you wish to use the lat ter types then special mounting arrangements have to be considered, as they are intended for use on printed boards.

The printed board for the prototype was supplied by RCS Radio who will be making boards available, either direct or through your usual supplier. Alternatively, we imagine that other manufacturers will also be making boards available.



This diagram shows the wiring terminations for the two mixer transformers.



The component overlay diagram shows the PC board from the component side. Pay particular attention when inserting polarity conscious components.

The dial arrangement consists of a drive mechanism and a scale. The drive is the well known planetary type sold under the Jabel brand and is available from Watkin Wynne Pty Ltd, 32 Falcon Street, Crows Nest 2065, or through your local supplier. The scale is simply a card calibrated and covered with a piece of sheet perspex. More will be said about the scale when alignment and calibration are discussed.

The case which we used was obtained from Radio Despatch Service, 869 George Street, Sydney, 2000. You may obtain a similar case from the above supplier, or you may be able to get a similar or other suitable type elsewhere. The case is a matter of choice but we strongly suggest that it be a metal one, to minimise the effect of body capacitance.

Construction of this little receiver is fairly straightforward. A good place to start is with the coils. These should be wound according to the information given in the table. The aerial and oscillator coils should be terminated according to the numbering given on the circuit, so that the windings match up with the

printed board. Make sure that the oscillator coil is firmly wound to ensure a stable oscillator signal. Pins 4 and 6 should be bridged.

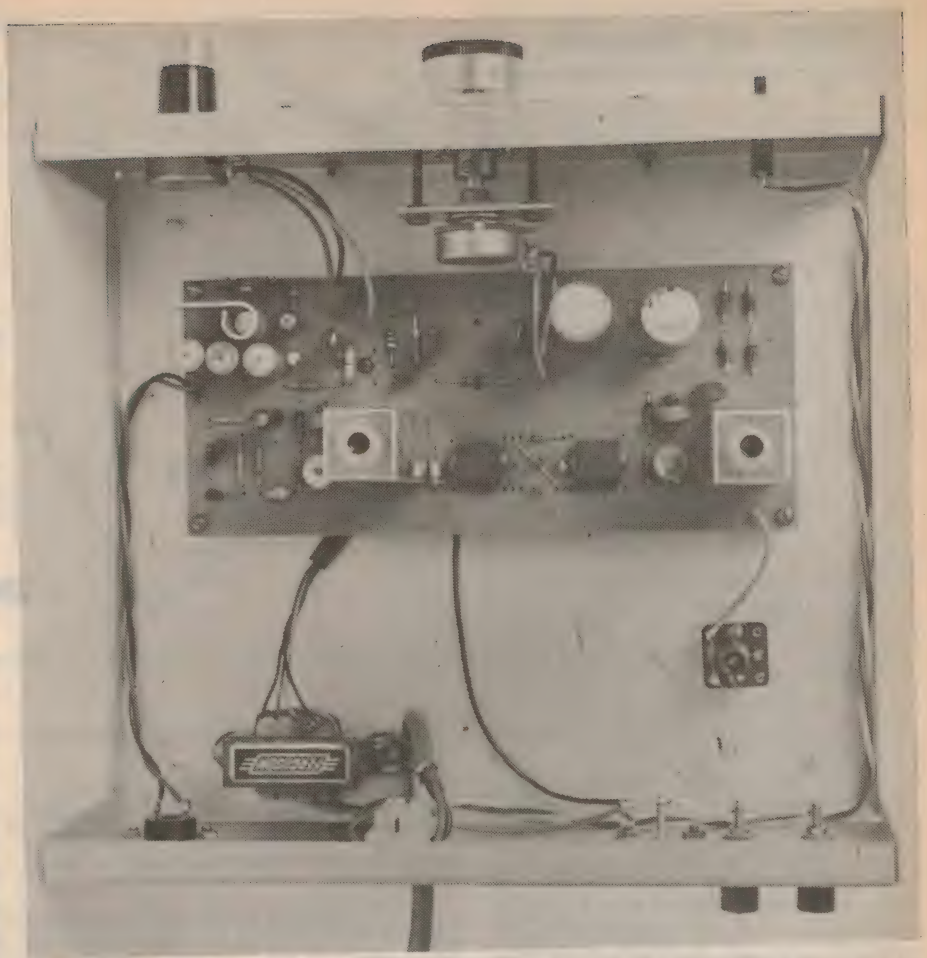
Winding the mixer transformers can be a little tricky. Make sure that you have sufficient length of wire, when twisted, to wind 15 turns. One turn constitutes a pass through both holes in the former. Keep the winding firm, otherwise you may have trouble getting on the 15 turns. On the other hand, the number of turns is not particularly critical and if you have space left, then you may add extra turns up to about 20 or so if you wish.

Having done the windings, the terminations have to be sorted out with a multimeter and the terminations done according to the drawing.

Assembly of the printed board is best done by fixing the small components first. Resistors and diodes go first, followed by capacitors, transistors, IC, and finally the coils. Make sure that all diodes, transistors and electrolytic capacitors are connected with correct polarity.

Before fixing the aerial and oscillator coils to the board, bend the can lugs over so that they interfere with the mounting screw holes. This ensures that when you screw the coil to the board, the can will be effectively earthed. Fixing the mixer transformers may be effected by using small pieces of double-sided adhesive tape, or simply by using a suitable glue, such as Tarzan's Grip.

When soldering components to the board, always have a good, clean, hot iron. Use a good quality resin cored solder and avoid overheating components. But at the same time, avoid "dry" joints.



An internal view of the prototype showing the layout of major components. Use this photograph in conjunction with the wiring diagram to aid construction.

Apart from the external leads to and from the board, there are two "jumpers" required. One is from the centre tap of the mixer input transformer. Run a piece of hookup wire from the copper pad under the board to the emitter connection of the BC549 preamplifier transistor. Another lead must also be run from the

PARTS LIST

1 Metal case, 230mm wide x 90mm high x 210mm deep
1 Jabel planetary dial drive, with pointer
2 Knobs
1 Switch, SPDT
1 Printed board, 78mm x 184mm, code 76R12
1 Power transformer, 240V primary, 12.6V CT secondary, 2.5VA
1 Terminal strip, 3-position
1 Speaker socket, 2-pin
1 Coax socket
2 Terminals, 1 red, 1 black
4 Spacers, brass, ½in long, tapped ⅛in Whitworth
4 Silicon diodes, EM401 or similar
4 Variable capacitance diodes, BA102
4 Hot-carrier diodes, 5082/2811 (see text)
1 Silicon diode, 1N914A or similar
1 Zener diode, BZX79 C12
1 Transistor, 2N5485 or similar
1 Transistor, BC549, BC209, BC109
1 IC, TAA300, with flag heat sink
2 RF chokes, 820uH
1 Coil former, Neosid 7.6mm x 32mm with grade 900 slug
2 Coil formers, Neosid 7.6mm x 58mm with can and grade 900 slug

RESISTORS (½W unless stated otherwise)

1 47 ohms
1 680 ohms
2 1k
2 2.2k
2 4.7k
1 25k trimpot
1 33k
1 47k
1 100k log pot
1 100k linear pot
1 390k
1 3.3M

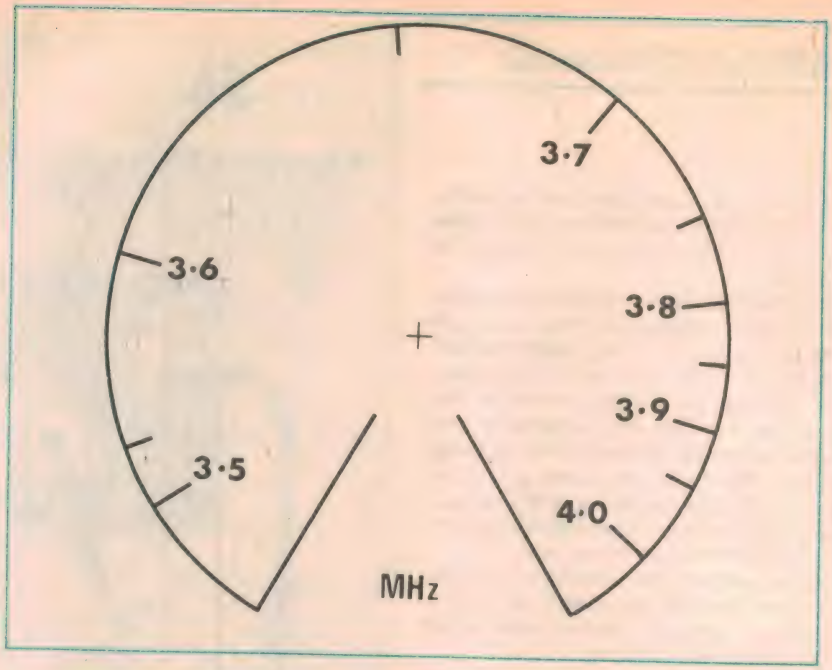
CAPACITORS

1 39pF NPO ceramic
1 47pF polystyrene
2 6-60pF Philips trimmer
1 100pF polystyrene
1 220pF polystyrene
2 .01uF 100V greencap
1 0.22uF 100V greencap
1 .047uF 25V ceramic
4 0.1uF 100V greencap
1 0.47uF 35VW tantalum
1 22uF 16VW electrolytic
1 25uF 6.4VW electrolytic
1 125uF 10VW electrolytic
1 200uF 10VW electrolytic
1 320uF 6.4VW electrolytic
1 1000uF 25VW electrolytic
1 2200uF 16VW electrolytic

SUNDRIES

Hookup wire, solder, solder lugs, rubber grommet, 3-core flex, 3-pin plug, cable clamp, screws, nuts.

Note: Resistor wattage ratings and capacitor voltage ratings are those used on the prototype. Components with higher ratings may generally be used, providing they are physically compatible. Components with lower ratings may also be used in some cases if available, providing ratings are not exceeded.



+9V point from the power supply, to the corresponding point at the audio amplifier output. Or, it may be run to the speaker socket terminal.

Fitting components to the case is simple enough and the location of the items may be seen in the photographs. However, two points are worth mentioning. It is most important that you use metal spacers to fix the printed board to the case. If this is not done there is likely to be a hum problem. Also, when fixing the tuning potentiometer to the dial drive, we used some long screws and a small metal plate to which the potentiometer is fixed. The spindle is cut to length and mounting is adjusted so that the potentiometer rotates smoothly.

Although the audio IC is likely to be run at well below its full output capability, it would be wise to fit a heat sink to the IC. You can either buy one or alternatively, fashion one out of a piece of scrap aluminium. We made one from a piece measuring 50mm x 12mm. One end was wound around a 5/16in diameter drill and the resulting loop was adjusted by hand so that it was a neat fit over the case of the IC.

With all the items fixed to the case, all interconnecting wiring can be done. After terminating the mains lead in the terminal strip, we ran the neutral lead direct to the transformer and the active via the switch on the front panel. The mains earth was taken to a lug under the coax aerial socket mounting screw. We ran a lead from the earth copper at the back of the board, to the same earth lug. The coax socket is connected to the other aerial terminal and the 220pF capacitor is swung across to the trap coil.

The 39pF capacitor is connected directly across the trap coil and the 4.7k resistor is also connected directly to the tuning potentiometer.

Before making the adjustments, a careful check should be made to ensure that all components are in the right places and that there have been no errors or omissions.

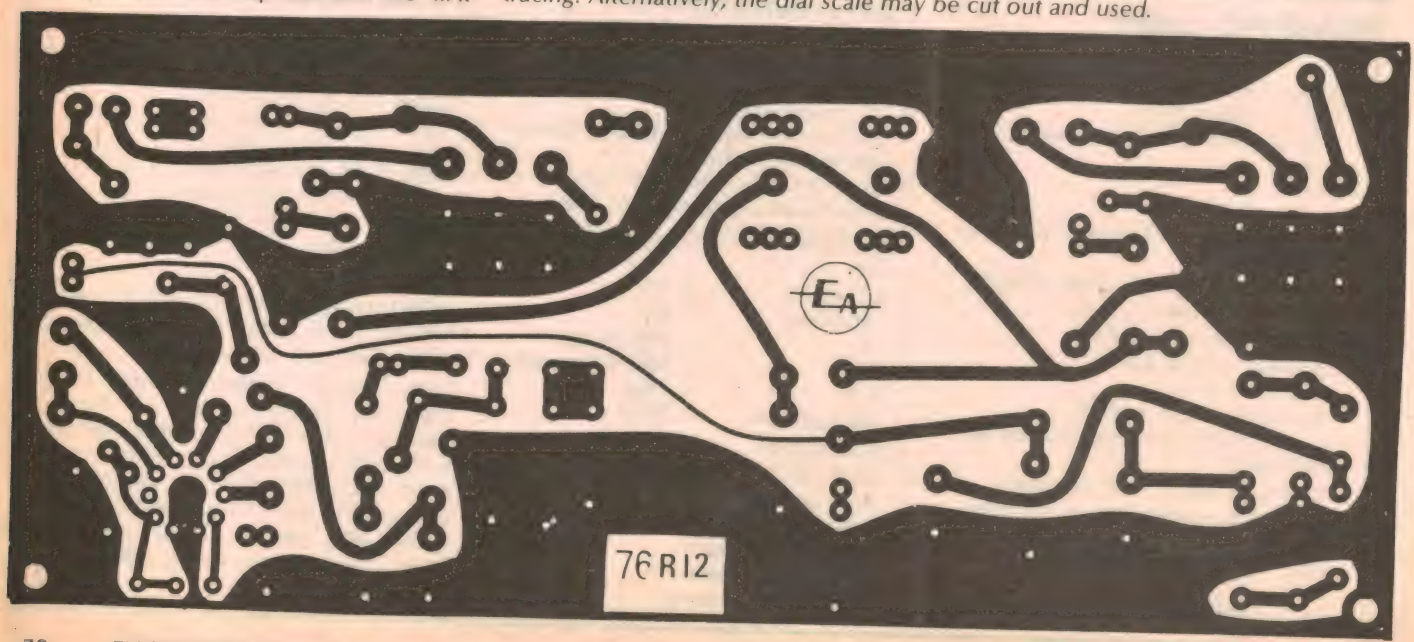
Satisfied that all is well, turn the volume control right off and set the trimpot on the audio amplifier to mid position. Lift the lead from the +9V supply point and insert a multimeter with it set to the 10mA range or higher. Switch on, and adjust the trimpot for a reading of 8mA. Then switch off and resolder the lead.

Although we have not mentioned it so far, a dial scale is needed and we have reproduced a full size copy of the one which was used on the prototype. Due to the variations associated with varicap diode tuning, more than likely your dial calibrations will not be the same as those of the prototype. However, the reproduced scale can be useful as a guide as to what to expect. Just how you settle on your dial scale will be up to each individual to decide.

Whatever you may decide, two points on your scale will correspond with those on the prototype. They are the 3.5MHz and the 4.0MHz points and these should be marked before calibration and alignment is done.

We will assume that you have access to a signal generator or some other means of identifying frequencies within

The dial scale (above) and the PC board pattern are shown here actual size to facilitate tracing. Alternatively, the dial scale may be cut out and used.

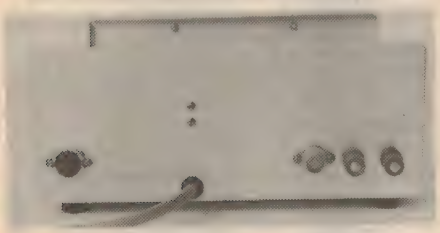


the range of interest. Set the generator to 3.5MHz and set the receiver dial to the same point on the dial. Switch on and adjust the slug in the oscillator coil until a signal is heard. Now adjust the slug in the aerial coil for maximum response.

Now set both the receiver and generator for 4MHz. Adjust the oscillator trimmer until a signal is heard. Then adjust the trimmer on the aerial coil for maximum response. In common with all alignment procedures of this nature, it is now necessary to go back and forth from one end of the scale to the other, each time making a smaller adjustment to the appropriate slug or trimmer until both end points are accurately set. Alignment is then complete.

Although alignment is finished, we still have to do something about calibration. If you have a copy of the original in place, then by means of the generator or some other source of known marker frequencies, check each of the points along the scale. If you are lucky they may be close enough, and you may elect to use the copy of the original scale. On the other hand, you may decide to set your own calibration points.

You will have noticed that the scale



A view of the rear panel. The speaker socket is at left, with the aerial socket and terminals to the right.

calibrations are not linear. This is due to the characteristics of the tuning diodes and other constants relating to them in the tuning system, and is difficult to avoid, short of taking rather elaborate steps.

With your direct conversion receiver now operational, you will need a good aerial system for best results. Preferably, the aerial should be one cut for the 3.5MHz band, with a properly matched coax feeder. Given this, the little receiver should give a good account of itself on signals from amateurs, etc, operating on CW and SSB, within the tuning range.

If you find that you are having trouble with signals transmitting in the range between 7MHz and 8MHz breaking through and being tuned along with the wanted signals, then the trap in the aerial circuit needs adjustment. As an example you may be receiving the standard time and frequency station VNG, actually on 7.5MHz, on 3.75MHz on your dial. If this is the case, tune in the unwanted signal and adjust the slug in the trap for minimum response. By adjusting the trap here in the middle of the band, it should be effective right across the tuning range.

Handyman successes—and failures

The do-it-yourself types who attempt their own TV repairs experience varying degrees of success—ranging all the way from doing a good job at a considerable cost saving to complete failure, plus unnecessary expense and, sometimes, adding more damage to the original fault.

With the advent of colour, and a new colour TV set, a lot of people find themselves with a monochrome receiver on their hands earmarked as a second set for the rumpus room or children's den.

If, or when, it gives trouble there is a strong temptation to "have a go" themselves, on the basis that it is no longer the main set, not worth very much, and that the cost of a complete overhaul may well be more than it is worth. So, on the basis that there is little to lose, they tackle it themselves.

The average handyman prides himself on being able to repair just about anything around the home—from the lawnmower to the family car; from the electric iron cord to the TV set. As readers can well imagine, this last one is often his Waterloo.

He usually tackles the TV set by cleaning out the accumulated dust and then purchasing new valves to replace any suspect ones. The reasons for suspecting particular valves are many and varied.

"It doesn't light up as bright as the others."

"It looks crook."

"It gets too hot."

And so on . . .

A common trap is the EHT rectifier.

"It's got to be that one, 'cos it's the only one that doesn't light."

There are two traps here. One is the fact that the design and/or location of some EHT rectifiers makes it almost impossible to see the filament. The other is the fact that this filament is not supplied from the normal heater line, but from a loop around the EHT transformer.

As a result, any malfunction which seriously upsets the operation of the line output stage will most likely show up as failure of the EHT rectifier filament. But try to convince some customers of this. On more than one occasion I have failed to get this message across, the customer insisting on buying a new valve. Later, when it has failed to cure the trouble, he comes back, somewhat sheepishly, for more assistance.

I was prompted in this brief reminiscence by my most recent do-it-yourself type. He walked into the shop on a Saturday morning and handed me a piece of paper with "23FSP4" written on it and asked, "Have you got one of those?".

He went on to explain that his TV set had suffered from a very dark picture for some time, and had now lost the picture entirely. Since a friend had a similar set, with similar symptoms, which had been fixed by fitting a new picture tube, he reasoned that his could be fixed in the same way.

Also, he had made a careful study of how the tube was fitted in the cabinet and felt quite sure that, if he took care, he wouldn't have any trouble fitting the new tube.

It so happened that I did have such a tube in stock but, before handing it over I advised him of the dangers associated with careless handling of a picture tube, the damage they could cause if they imploded, and the main precautions to take in handling them.

Then, the transaction completed, he loaded the tube into his car and drove off to an interesting Saturday afternoon's work fitting it in the cabinet.

I don't suppose I was really surprised when he turned up on the following Monday morning, together with the set and the rather sheepish confession that it still did not work. Would I have a look at it and give him a report when he called back late in the afternoon?

My first step was to check his installation of the tube. I was agreeably surprised to find that he had done everything correctly; I could not have done a better job myself.

Next I switched the set on and checked the EHT, which was exactly zero. This set uses a 6AL3 damper diode with a 27 ohm fusible resistor in the plate circuit, the latter intended to provide protection in the event of circuit malfunctions, particularly any which affects the line drive to the 6CM5 line output valve. This resistor was cooked.

Leaving it for the moment I checked for bias on the grid of the 6CM5. There was none—a clear indication of lack of line drive and, equally, of the failure of the line oscillator stage.

From previous experience I knew that the most likely cause of such a failure was an open circuit horizontal oscillator coil. Sure enough, a quick check with the ohmmeter confirmed this.

It needed only a few minutes to replace the faulty coil and faulty resistor, after which the set sprang into life. I aligned the new oscillator coil and gave all the other controls and adjustments a routine check.

The set was now working reasonably well, but I went over the valves and checked each one in the tester, experience having taught me that this model set, at this age, usually had one or two just about ready to replace.

In this case I found a weak 6X9 in the IF strip and, when this was replaced, the old set turned in a virtually new performance. It was a very happy customer who picked up his set late that afternoon; not only because it was working well, but also because it had turned out to be such a simple fault. Also, I suspect, because of his personal involvement in the job.

And did the old picture tube really need to be replaced? I have no way of knowing and I felt it more diplomatic not to raise the point. Doubtless the customer had asked himself the same question but would prefer not to be reminded of the possibility that he had bought a new tube unnecessarily. So, while ever the question remained unanswered, he could at least console himself with the possibility that it was weak.

But I suspect he may hesitate in future before he makes such a sweeping diagnosis.

Still on the do-it-yourself theme, here are a couple of letters from readers whose efforts have been rather more successful. The first is from a Mr G. P. of Perth, WA, who, while only an amateur in matters electronic, was still able to carry out a worthwhile overhaul on an old TV set. He writes:

"Carried out a satisfying exercise on our B&W TV set which is some 17 years old. Received a letter from the maintenance firm saying that they were discontinuing the contract owing the inability to obtain spare parts.

"When it duly failed, I took a deep breath, and removed the back panel. The most impressive feature was the number of old paper capacitors, many of which had shed their wax content with the summer heat here. Some were covered in dust which was arranged in a sort of corona pattern built up around the capacitor.

"Needless to say, many of the said capacitors were functioning more as resistors. Tore the whole board down, and replaced everything with modern plastic equivalents, plus new valves and electrolytics.

"With careful alignment the result was quite startling, as it now pulls in a country TV station about a hundred miles from here, doubtless due to some freak reception effect."

Well, that's one enthusiast's solution to the problem of keeping an old TV set going for a few more years. Whether it is worthwile depends a good deal on who does the work. If it is by a professional serviceman the labour cost might well be far more than the set was worth, particularly if a nasty fault was discovered half way through the exercise.

But where, as in this case, it can be done by the owner the only tangible expense is that for new parts. Not only does the labour not cost anything, the person supplying it might actually enjoy the exercise, and learn something into the bargain.

And from another reader comes a tip which is worth remembering. He is Mr E.R., of Moorabbin, Victoria. He writes:

"An article by you several years ago referred to faulty valves caused by the deposit of a metallised film on the mica separators inside the envelope.

"My aged mantel receiver recently suffered fluctuating sensitivity in the front end and a VTVM check of the 6BE6 converter valve showed the grid to be slightly positive. A resistance check revealed some 30M between the grid pin and the plate and screen pins.

"I pushed a piece of hookup wire over the grid pin so that the wire was in contact with it and making sure that the insulation completely covered it. Another lead was connected to the plate and screen pins.

"I connected the plate/screen lead to a suitable chassis point on my car and the grid pin to one of the HT leads removed from a spark plug. Starting the engine did the rest. An ohmmeter check revealed no readable conductance between the grid and other pins. More importantly, the set now behaved normally."

In lighter vein, here is a story which demonstrates some kind of poetic justice. It was related to me by my amateur friend, who found himself caught up in a typical TV interference problem, of which he stood accused.

More specifically, three of his neighbours confronted him one morning with the accusation that his amateur transmissions were causing interference to their TV sets. One of the three, who seemed to have adopted the role of spokesman, was particularly indignant, demanding that "... something be done about it!".

My friend, on the other hand, decided to play it cool. For one thing, he was pretty well convinced that he was not to blame. As he put it to me, "Whenever anyone experiences interference on radio or TV, and there is an amateur in the district, he is sure to cop the blame. In fact, the amount of interference caused by amateurs is minimal and, what is more, is controllable. So I knew that, one way or another, I could clear myself."

To them he explained that he is required, under the terms of his licence, to keep a log of all transmissions. Therefore, if they would keep a record of all cases of interference over, say, the next week, this could then be compared with his log and it would be easy to see which of his transmissions, if any, was the likely cause.

They agreed to this, though without much enthusiasm. But they did turn up the next weekend with a list of interference times. When these were compared with the log book it was obvious that none of the times coincided with the transmissions.

"But", said my friend, "they didn't believe me. While they didn't say as much, it was obvious that they thought I had faked the log book."

On the other hand, there was now no doubt in his mind that he was not responsible, so he could afford to be a bit cocky. "Well," he told them, "since it is not being caused by my transmissions, there is little more I can do to help you. I suggest that you contact the Radio Branch and ask for their help. They are well equipped to track down such interference, and will be quite willing to help."

But, for some reason best known to themselves, they elected not to take his advice but continued to complain, to other people, about his transmissions. The next thing that happened was that my friend's annual holidays fell due, and he took off down the coast for several hundred miles, where he remained for the next three weeks. And during this time the interference continued.

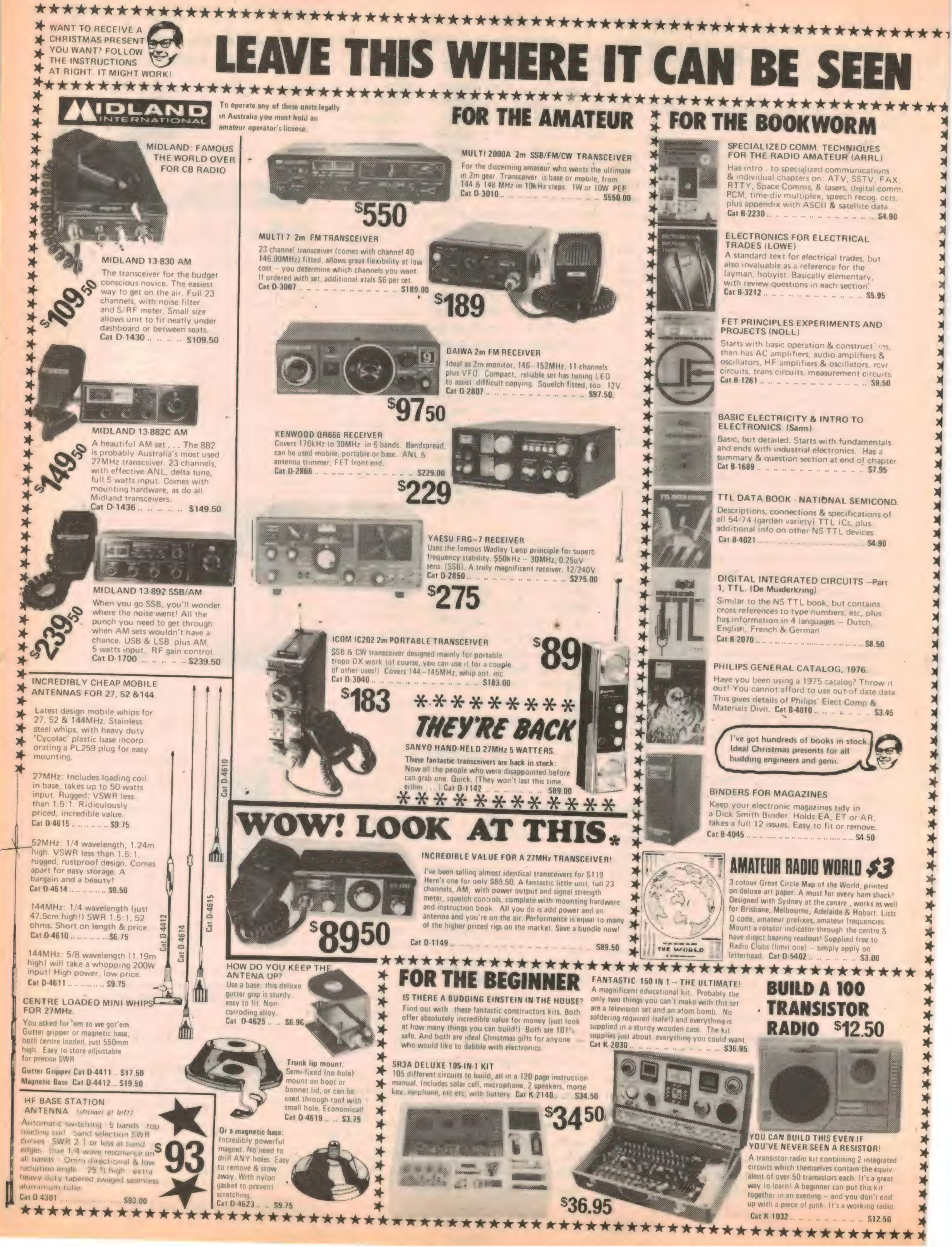
By now the group were forced to admit , rather reluctantly, that "... he probably was not to blame."

And that was the last my friend heard of the matter, at least directly and for several months. Then the sequel filtered back to him via a friend of a friend, etc.

It seemed that, a few weeks after my friend's holidays, the spokesman's TV set packed up and was forced to call in a serviceman. The serviceman quickly found the trouble — the technical details were lost in transit — and, as he was fixing it, he commented, "This fault would have been causing interference on your picture. Not only that, it has probably been causing interference to all the sets in the immediate vicinity."

As I said at the beginning, some kind of poetic justice. And, of course, it also explains why the group, and the spokesman in particular, suddenly fell silent after making such a fuss.

As to the nature of the fault, I can only guess. The most likely explanation is an EHT fault similar to that which I described in the May 1976 issue. This was a dry joint in the top cap of the EHT rectifier, the resultant arc causing severe interference in both the set itself, and also in a neighbouring set.


WANT TO RECEIVE A CHRISTMAS PRESENT YOU WANT? FOLLOW THE INSTRUCTIONS AT RIGHT. IT MIGHT WORK!
LEAVE THIS WHERE IT CAN BE SEEN
MIDLAND INTERNATIONAL
To operate any of these units legally in Australia you must hold an amateur operator's license.
MIDLAND: FAMOUS THE WORLD OVER FOR CB RADIO
MIDLAND 13-830 AM
The transceiver for the budget conscious novice. The easiest way to get on the air. Full 23 channels, with noise filter and S/RF meter. Small size allows unit to fit neatly under dashboard or between seats.
Cat D-1430 .. .. $109.50
$109.50
MIDLAND 13-882C AM
A beautiful AM set . . . The 882 is probably Australia's most used 27MHz transceiver. 23 channels, with effective ANL, delta tune, full 5 watts input. Comes with mounting hardware, as do all Midland transceivers.
Cat D-1436 .. .. $149.50
$149.50
MIDLAND 13-892 SSB/AM
When you go SSB, you'll wonder where the noise went! All the punch you need to get through when AM sets wouldn't have a chance. USB & LSB plus AM, 5 watts input. RF gain control.
Cat D-1700 .. .. $239.50
$239.50
FOR THE AMATEUR
MULTI 2000A 2m SSB/FM/CW TRANSCEIVER
For the discerning amateur who wants the ultimate in 2m gear. Transceiver is base or mobile, from 144 & 148 MHz in 10kHz steps. 1W or 10W PEP
Cat D-3010 .. .. $550.00
$550
MULTI 7 2m FM TRANSCEIVER
23 channel transceiver (comes with channel 40 146.00MHz) fitted, allows great flexibility at low cost – you determine which channels you want. If ordered with set, additional xtals $6 per set.
Cat D-3007 .. .. $189.00
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DAIWA 2m FM RECEIVER
Ideal as 2m monitor, 146–152MHz, 11 channels plus VFO. Compact, reliable set has tuning LED to assist difficult copying. Squelch fitted, too. 12V
Cat D-2807 .. .. $97.50.
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KENWOOD QR666 RECEIVER
Covers 170kHz to 30MHz in 6 bands. Bandspread, can be used mobile, portable or base. ANL & antenna trimmer, FET front end.
Cat D-2866 .. .. $229.00
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YAESU FRG-7 RECEIVER
Uses the famous Wadley Loop principle for superb frequency stability. 550kHz – 30MHz, 0.25uV sens. (SSB). A truly magnificent receiver. 12/240V
Cat D-2850 .. .. $275.00
$275
ICOM IC202 2m PORTABLE TRANSCEIVER
SSB & CW transceiver designed mainly for portable tropo DX work (of course, you can use it for a couple of other uses!) Covers 144–145MHz, whip ant. inc.
Cat D-3040 .. .. $183.00
$183
$89
THEY'RE BACK
SANYO HAND-HELD 27MHz 5 WATTERS.
These fantastic transceivers are back in stock: Now all the people who were disappointed before can grab one. Quick. (They won't last this time, either . . .) Cat D-1142 .. .. $89.00
INCREDIBLY CHEAP MOBILE ANTENNAS FOR 27, 52 & 144.
Latest design mobile whips for 27, 52 & 144MHz. Stainless steel whips, with heavy duty 'Cycolac' plastic base incorporating a PL259 plug for easy mounting.
27MHz: Includes loading coil in base, takes up to 50 watts input. Rugged; VSWR less than 1.5:1. Ridiculously priced, incredible value.
Cat D-4615 .. .. $9.75
52MHz: 1/4 wavelength, 1.24m high. VSWR less than 1.5:1. rugged, rustproof design. Comes apart for easy storage. A bargain and a beauty!
Cat D-4614 .. .. $9.50
144MHz: 1/4 wavelength (just 47.5cm high!) SWR 1.5:1, 52 ohms. Short on length & price.
Cat D-4610 .. .. $6.75
144MHz: 5/8 wavelength (1.19m high) will take a whopping 200W input! High power, low price.
Cat D-4611 .. .. $9.75
Cat D-4610
Cat D-4412
Cat D-4614
Cat D-4615
CENTRE LOADED MINI-WHIPS FOR 27MHz.
You asked for 'em so we got'em. Gutter gripper or magnetic base, both centre loaded, just 550mm high. Easy to store adjustable for precise SWR
Gutter Gripper Cat D-4411 .. $17.50
Magnetic Base Cat D-4412 .. $19.50
HF BASE STATION ANTENNA (shown at left)
Automatic switching 5 bands top loading coil band selection SWR curves SWR 2:1 or less at band edges true 1/4 wave resonance on all bands Omni directional & low radiation angle 25 ft high extra heavy duty tapered swaged seamless aluminium tube
Cat D-4301 .. .. $93.00
$93
WOW! LOOK AT THIS.
INCREDIBLE VALUE FOR A 27MHz TRANSCEIVER!
I've been selling almost identical transceivers for $119 Here's one for only $89.50. A fantastic little unit, full 23 channels, AM, with power output and signal strength meter, squelch controls, complete with mounting hardware and instruction book. All you do is add power and an antenna and you're on the air. Performance is equal to many of the higher priced rigs on the market. Save a bundle now!
Cat D-1149 .. .. $89.50
$89.50
HOW DO YOU KEEP THE ANTENA UP?
Use a base: this deluxe gutter grip is sturdy, easy to fit. Non-corroding alloy.
Cat D-4625 .. .. $6.96
Trunk lip mount: Semi-fixed (no hole) mount on boot or bonnet lid, or can be used through roof with small hole. Economical!
Cat D-4619 .. .. $3.75
Or a magnetic base: Incredibly powerful magnet. No need to drill ANY holes. Easy to remove & stow away. With nylon gasket to prevent scratching.
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FOR THE BOOKWORM
SPECIALIZED COMM. TECHNIQUES FOR THE RADIO AMATEUR (ARRL)
Has intro. to specialized communications & individual chapters on: ATV, SSTV, FAX, RTTY, Space Comms, & lasers, digital comm, PCM, time-div multiplex, speech recog. ccts, plus appendix with ASCII & satellite data.
Cat B-2230 .. .. $4.90
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A standard text for electrical trades, but also invaluable as a reference for the layman, hobyist. Basically elementary, with review questions in each section.
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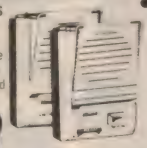
Starts with basic operation & constructions, then has AC amplifiers, audio amplifiers & oscillators, HF amplifiers & oscillators, rcvr circuits, trans circuits, measurement circuits.
Cat B-1261 .. .. $9.50
BASIC ELECTRICITY & INTRO TO ELECTRONICS (Sams)
Basic, but detailed. Starts with fundamentals and ends with industrial electronics. Has a summary & question section at end of chapter
Cat B-1689 .. .. $7.95
TTL DATA BOOK - NATIONAL SEMICOND.
Descriptions, connections & specifications of all 54/74 (garden variety) TTL ICs, plus additional info on other NS TTL devices
Cat B-4021 .. .. $4.90
DIGITAL INTEGRATED CIRCUITS – Part 1, TTL. (De Muiderkring)
Similar to the NS TTL book, but contains cross references to type numbers, etc, plus has information in 4 languages – Dutch, English, French & German
Cat B-2070 .. .. $8.50
PHILIPS GENERAL CATALOG, 1976.
Have you been using a 1975 catalog? Throw it out! You cannot afford to use out-of-date data This gives details of Philips' Elect Comp & Materials Divn. Cat B-4010 .. .. $3.45
I've got hundreds of books in stock. Ideal Christmas presents for all budding engineers and genii.
BINDERS FOR MAGAZINES
Keep your electronic magazines tidy in a Dick Smith Binder. Holds EA, ET or AR, takes a full 12 issues. Easy to fit or remove.
Cat B-4045 .. .. $4.50
AMATEUR RADIO WORLD $3
3 colour Great Circle Map of the World, printed on deluxe art paper. A must for every ham shack! Designed with Sydney at the centre, works as well for Brisbane, Melbourne, Adelaide & Hobart. Lists Q code, amateur prefixes, amateur frequencies. Mount a rotator indicator through the centre & have direct bearing readout! Supplied free to Radio Clubs (limit one) – simply apply on letterhead. Cat D-5402 .. .. $3.00
FOR THE BEGINNER
IS THERE A BUDDING EINSTEIN IN THE HOUSE?
Find out with these fantastic constructors kits. Both offer absolutely incredible value for money (just look at how many things you can build!) Both are 101% safe. And both are ideal Christmas gifts for anyone who would like to dabble with electronics
SR3A DELUXE 105-IN-1 KIT
105 different circuits to build, all in a 120 page instruction manual. Includes solar cell, microphone, 2 speakers, morse key, earphone, etc etc, with battery Cat K-2140 .. .. $34.50
$34.50
FANTASTIC 150 IN 1 – THE ULTIMATE!
A magnificent educational kit. Probably the only two things you can't make with this set are a television set and an atom bomb. No soldering required (safe!) and everything is supplied in a sturdy wooden case. The kit supplies just about everything you could want.
Cat K-2030 .. .. $36.95.
$36.95
BUILD A 100 TRANSISTOR RADIO $12.50
YOU CAN BUILD THIS EVEN IF YOU'VE NEVER SEEN A RESISTOR!
A transistor radio kit containing 2 integrated circuits which themselves contain the equivalent of over 50 transistors each. It's a great way to learn! A beginner can put this kit together in an evening – and you don't end up with a piece of junk. It's a working radio.
Cat K-1032 .. .. $12.50

RING WANTED ITEMS IN RED!

FOR THE HANDYMAN

WANT TO IMPROVE COMMUNICATIONS IN YOUR HOUSEHOLD

Instal an intercom! Or two. Dick has an intercom to suit every need. From a simple 2 station (e.g. house to shed) up to a multi station master system. See them today and save your voice for shouting at Christmas.

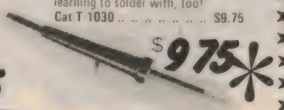


Cat F-1020 **$12.00**

IF YOU'RE READING THIS AD YOU PROBABLY HAVE AN IRON

Soldering iron, that is. But chances are, you've been using the same iron as you do the guttering with. If so, try this iron: for all general electronic work, the Weller SP25D. Runs from mains, but is lightweight, has stainless steel barrel. Ideal for learning to solder with, too!

Cat T-1030 .. .. $9.75



$9.75

$3.50

WHEN YOU INSTALL YOUR NEW INTERCOM . . .

(The one you just got above!) You don't want to leave cables dangling all over the place, do you? Staple them to the wall with our cable stapler! Of course, you could also use it for your new speaker leads, for the new burglar alarm wiring, etc etc. Takes standard staples, tensions the cable as you go. Makes the job a dream

Cat T-5615 .. .. $3.50

$7.95

DONT BLOW A FUSE OR YOUR COOL: You know what it's like trying to find fuse wire in the dark! Replace fuses with these fantastic little plug-in circuit breakers. All you do is press to re-set. So simple anyone can install them in just a couple of seconds. Tremendous time saver! Cat S-5508 (8 AMP) or Cat S-5515 (15 AMP) .. $7.95

ARE YOU A CONSTRUCTIVE HANDYMAN?

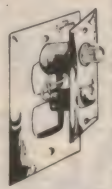
If so, you might like a drill speed control. There's only one catch. You have to build it yourself (and save lots of bickies doing so!) But it's an easy kit to build. So don't panic. When finished (!) it will control the speed of your hand drill from practically zero up to nearly full (normal) RPM, while maintaining useable torque (on reference to ABC TV). Suitable for drills up to 3A.

Cat K-3080 .. .. $9.75

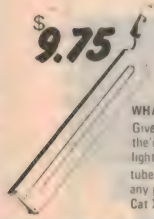
CREATE YOUR OWN MOOD BY MOODLIGHTING

Sure you can make one – but for this price? It's neat, compact and functional. You would be hard pressed to make one as good as this! The 'Moonglo' light dimmer will handle incandescent or fluoro lamps up to a total of 500VA, and RFI suppression is fitted. Installation is simple (but should be done by an electrician)

Cat X-1112 .. .. $6.90



$9.75



$9.75

This fantastic dimmer is much, much more than JUST a dimmer! It will automatically turn your lights on to a pre-determined level as night advances. Imagine the advantages of returning home to a house which looks occupied. Think of the security applications. Then look at the price. UNDER $10.00. Incredible is hardly the word!

Cat X-1113 .. .. $9.95

WHAT A BRIGHT IDEA . . .

Give him a fluoro lamp to put in the car, boat or van. Clean, white light, uses standard replaceable tube. Can be mounted in just about any position; requires 12V @ 8W.

Cat X-1082 .. .. $9.75

FOR THE AUTO ENTHUSIAST

MONO & STEREO RADIOS LOOK ALMOST IDENTICAL

$79

CAR CASSETTE STEREO

You know what's wrong with most car cassettes? They're made down to a price: cheap & nasty. Dick looked at these and rejected them, then went overseas to find a good one. He found this quality unit using the famous Belgian Starr mechanism. It also has a fast forward button – something many of the cheaper units miss out on. If you want quality, this is the cassette you need. Cat A-6485 .. .. $79.00

FM·AM

AM/FM CAR RADIO

There's just no point in buying an AM only car radio when for so little extra you can be enjoying the fine music and high fidelity of the new FM stations. Pushbutton type, high power output (6W) and in-dash mount add up to one thing: VALUE.

Cat A-5982 .. .. $69.00

AM/FM STEREO CAR RADIO

You can now receive STEREO in your car with this brand new import: A handsome unit which features full FM (MPX) stereo reception and a massive 12 watts output (2 x 6W). Has tone and balance controls, too. Push button tuning, too. It will pick up normal AM beautifully.

Speakers extra for both radios!

Cat A-5983 .. .. $89.00

POWER PLUS!

DO YOU LIKE MUSIC IN YOUR CAR?

How about LOUD music? Fan-tastic. We have something for you: a car stereo power booster. It's a sad fact of life that most car stereos have just a couple of watts output. And that's barely enough to get above road noise, let alone sound like hi-fi.

The stereo power booster is simply installed in your speaker leads (powered by car battery). And instead of your measly couple of watts, you get a full 10 watts per channel. That's as much as many home stereos! Easy installation (instructions supplied) just a few minutes work and you can be driving around the bend (?)

Cat A-6612 .. .. $27.50

$27.50

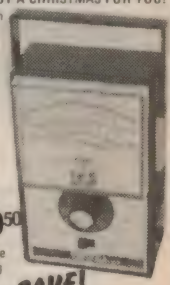
10 WATTS

TUNE YOURSELF

HOME MECHANICS: HAVE WE GOT A CHRISTMAS FOR YOU!

You don't need to be told how much your car is costing these days. You want to save some money, right?

Solution: Do your own tuning: It's easier than you might think. Especially with a tune-up analyser such as this little beauty. In conjunction with a timing light, you can do all electrical tuning and carburettor adjustment in just a couple of hours. You'll have paid for the units after just a couple of tunes in saved petrol alone. Checks RPM, dwell, points, volts, current, etc.



$29.50

And a timing light: Not your average neon types that have trouble lighting up a pinhead, these are powered xenon (white flash) types with pistol grip. Invaluable tuning aid.

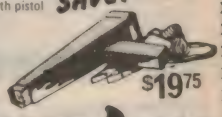
TUNE-UP ANALYZER COMPLETE WITH LEADS

Cat A-8512 .. .. $29.50

XENON TIMING LIGHT

Cat A-8505 .. .. $19.75

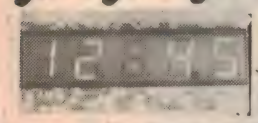
SAVE!



$19.75

SAVE SAVE SAVE

DICK SMITH HAS THE MA1002 ALARM CLOCK KIT DOLLARS CHEAPER THAN HIS COMPETITORS



The very latest 'clock on a chip' a 4 digit alarm clock built onto the one IC chip **including the display!** The chip is pre-assembled on a PCB (you don't have to worry about soldering the IC). All you need add is a set of switches to control time setting, etc. Simple!

YOU CAN SAVE MONEY WITH THE DICK SMITH KIT! If purchased separately from our competitors, parts would cost around $21.00. Dick's kit: $18.50! A bargain. And we supply the module, 6 miniature push buttons, alarm on/off slider switch, special transformer **and full data sheets.**

Cat K-3434 .. .. $18.50

$18.50

If you only want the module, we have that for just $11.50. (Picture shown at top) The board contains all the parts. See E.A. December for circuit details.

Cat X-1052 .. .. $11.50

A transformer to suit this chip & circuit:

Cat M-2822 .. .. $3.75

SEE EA DEC 76

FOR THE CONSTRUCTOR

NEW

The ULTIMATE TV Game Kit . . .

with sound and full digital scoring!

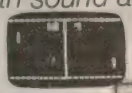
There are TV Games and there are TV games . . . but there is only one SELECTA-GAME!

This game conforms exactly to the original ET design and specifications there have been no cost-cutting corners or inferior substitutes. There are six selectable games; selectable bat sizes, selectable ball size; selectable angles; and you get both sound and full scoring. The kit is very easy to build; it is complete to the last detail (inc. front panel).

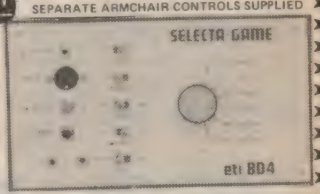
Demand is great; stocks are limited. All orders filled in strict priority of receipt.

You COULD be playing TV games tonight. (The ratings periods are over for a few months so the programs are pretty lousy. Show your disgust by playing TV games instead!)

SEE ETI NOV 76

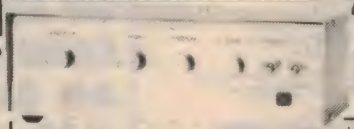


CONTROL UNIT ONLY SHOWN.
SEPARATE ARMCHAIR CONTROLS SUPPLIED



MUSICOLOUR III

SEE EA APRIL 1976



$49.50

COMPLETE TO THE LAST DETAIL!

Cat K-3140

$47.50

Cat K-3432

HAVE THE WILDEST CHRISTMAS PARTY ON THE BLOCK!

Don't just have coloured lights, have wild, with it modulated lights – just like the discos have. How do they do it? with a colour organ – like the Musicolour. It takes an audio signal (e.g. from your speaker terminals) and converts it to a drive for ordinary coloured lights. You can have 3 different colours – 1 for each of the channels for high, medium and low frequencies. Unreal!

By the way – did you know that you can use a Musicolour to modulate ordinary 240V Christmas tree lights – just connect them to the Musicolour 'middle' channel and connect to your hi-fi. Your Christmas tree will then light up to your music

SUPERB PLAYMASTER TWIN 25

$89.50

SEE EA SEPT 76

WITH DICK'S EXCLUSIVE CONSTRUCTION MANUAL

SPECIFICATIONS:

Power: 25 + 25W RMS (8 ohms)
Freq. response: 30Hz–20kHz (1dB, RIAA)
Channel Separation: 46dB @ 1kHz, 33dB @ 10kHz
Input Sensitivity: Phono at 1kHz: 2mV, 56k. Overload at 1kHz: 120mV. High level: 150mV, 36k.
Hum & Noise 70dB unweighted
THD: less than 0.2% typically less than 0.05%
Damping Factor greater than 60 @ 1kHz greater than 30 @ 30Hz
Stability Unconditional

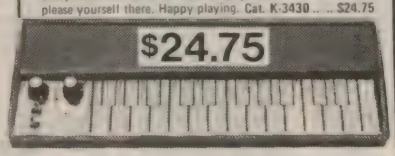
GIVE YOURSELF TWO CHRISTMAS PRESENTS! If you build the Playmaster Twin 25, you will save at least one hundred dollars (or more) on a commercial amplifier with similar specifications. So you would get two Christmas presents: a superb new 25W per channel amplifier AND the $100 in your pocket that you saved!

TOY ORGAN

SEE ETI AUG 76

LIBERACE – EAT YOUR HEART OUT!

If you've always wanted to play a musical instrument, here's your big chance – AFTER you've built it! And we don't really know what is easier: building or playing! Anyone who can use a soldering iron can make this mini-organ. And anyone can play it – all you do is touch your finger on the special keys and presto! You can play tunes instantly. The kit is complete except for the wooden case: we thought you would like to please yourself there. Happy playing. Cat. K-3430 .. .. $24.75



$21.50 SEE ETI AUG 75

WANT TO FIX YOUR OWN COLOUR TV?

Many hobbyists have the knowledge to fix their own colour TVs, but most lack the gear. Here's one item that won't break the bank: a crosshatch & dot generator, essential for convergence & purity adjustment. And it's simple to make.

Cat K-3290 .. .. $21.50

DICK SMITH ELECTRONICS GROUP

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DICK SMITH DEALERS:
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Veneman & Wyatt, Darwin (81 3491)
Wills & Co., Launceston (31 5688)
Hunts Electronics, Toowoomba(32 6944)
A.E. Cooling, Elizabeth South(255 2249)
The Record Centre, Griffith (621 577)
Altronics Parts, 105 Stirling St, Perth W.A. 6000 Ph 28 1599

Dealers prices may be higher due to transport costs.

ULLO RE DAS ERES ARGO DI KIS AN TAH OHO HO *

FOR THE HI FI'ER

A fantastic 'start-up' deck to begin your hi-fi system — or a great 'dubbing' deck for serious audiophiles.

WATTMASTER

STEREO CASSETTE DECK WITH AUTO STOP

$99

Cat A-3682

This real beaut deck has slider level controls, three neat switches (tape select - normal or CrO_2; noise cut - to eliminate hiss; and power on/off). Has piano key operation with auto stop feature. Microphone inputs (mics supplied) or phono jack inputs. Stereo headphone outlet. A fantastic deck for the price — limited quantities only!
Cat A-3682 .. .. $99.00

WHATEVER HAPPENED TO INFLATION. ITS DEAD!

LAST YEAR I SOLD SIMILAR DECKS FOR $139.95. LOOK AT THE PRICE NOW!

NEW

$27.50 ea. (or $55 a pair)

Walnut veneer

$17.50

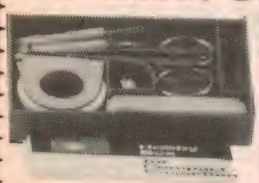
HI FI CHANGER

IS YOUR OLD PLAYER CLAPPED OUT?

Did you know that it's easy to change to a brand new Garrard. Your records will love you for it!

These fully automatic turntables can stack up to 6 records, they have a sapphire stylus in their ceramic cartridge, and have a cueing lift. Why put up with a worn-out player any longer. Get one of these mighty Garrards today!
Cat A-3036 .. .. $17.50

BASF HOBBY BOXES



If you own a tape recorder or cassette deck, you'll need to splice tapes. Don't try to do it with a razor blade and sticky tape — join the professionals. Use a BASF hobby box.

CASSETTE HOBBY BOX $12.15

Contains all you'll need to properly look after your valuable cassettes! With splicing template, non-magnetic scissors & tweezers (very important for noise-free splices) Philips & flat screw drivers, splicing tape & dispenser, 10m of leader tape, clips, pressure pads and spare screws. Ideal for making party tapes, sound effects or special effects!
Cat. C-3500 .. .. $12.15

REEL-TO-REEL HOBBY BOX $7.75

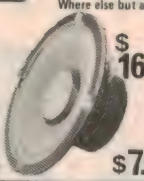
Similar to the cassette hobby box, but has gear just for the reel-to-reel set. Like a marking pencil, splicer, tape, red, green & white leader tape, stop foil, spool labels, tape clips, etc. The complete editing kit!
Cat. C-3502 .. .. $7.75

Don't forget Dick's full range of tapes & accessories for that last minute Christmas gift that you forgot to buy!

Fantastic Speaker Kit

HOW DO YOU JUDGE A SPEAKER?

The ultimate test of any speaker is how it sounds to you. After all, you're the one who has to live with it.
These sound great with just about any speaker.
But there are other considerations. Like how much room they will take up. Can they be fitted into a small space?
These are small.
How do they look. Will they tone in to the rest of my room?
They look great. (You can change the colour of the baffle)
And are they expensive.? It's one thing to buy a good speaker, another to pay a month's wages for it!
These are very reasonable.
Some kits are hard to put together. Do you have to have a degree to put them together?
These are dead easy.
Okay, I'm convinced. Where do I see these fabulous speakers?
Where else but a Dick Smith store or dealer.



$16.75

You can please yourself what speaker you put in this box . . . But Dick has a couple which would be ideal!
Cat C-2100: 28Hz – 20kHz response, 30 watts rating. Dual impedance, 4 or 8 ohms. Huge 16oz magnet! Twin cone for optimum performance.

$7.50

Cat C-2012: Famous C8MX , 10W (rms) 8 ohms, dual cone. Resp.. approx 30Hz - 18kHz. Recommended.

Don't forget Dick's full range of record accessories and equipment for that last-minute Christmas gift.

SANTA SMITH & STAFF WOULD LIKE TO WISH ALL CUSTOMERS AND FRIENDS A MERRY CHRISTMAS AND A SAFE AND PROSPEROUS NEW YEAR.

FOR THE LISTENER

ONLY $19.95

AM-FM AC-DC

LATEST LOOK AM/FM RADIO

You can play it on the beach, you can play it in the home. Dual power for economy (240V mains or internal batteries) and dual band for versatility. AM for normal DJ & news stations, FM for fine music stations. Absolutely mad give-away price for such a fine looker & good performer. **It sounds as good as it looks!**
Cat A-4320 .. .. $19.95

*Specially designed for Australia *Opens NEW listening realms *Complete VHF coverage

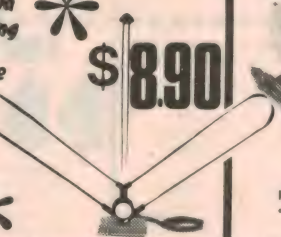
$8.90

VHF all band communicator. Covers bands below, AC/DC, compact portable. LED light for tuning. Earphone socket.

NOW ONLY $44.90
Cat. D-2833

FREE: EXCLUSIVE V.H.F. STATION GUIDE ONLY FROM US

530 – 1600kHz:	Normal AM broadcast band. All your normal local broadcast stations.
54 – 88MHz:	TV, Fire brigade, Ambulance, Police, Business Radios, etc.
88 – 108MHz:	New FM broadcast band.
108 – 136MHz:	AIR band: all aircraft (tiger moths to jumbos, tower, etc)
135 – 217MHz:	Amateurs, marine VHF, harbour control, Taxis, Police, Road Patrols, etc etc;



LOOK & WORKS BETTER THAN RABBITS EARS:

Deluxe TV antenna for indoor use in primary reception areas. Ideal for colour or B&W use, standard connector.
Cat L-4012 .. .. $8.90

FOR THE TECHNICIAN

DIGITAL DC $89.50

INCREDIBLY HANDY LITTLE DC VOLTMETER
••• DIGITAL READOUT IN END OF PROBE •••

Ideal for service, developmental work etc, this fantastic little DC voltmeter has a 3 digit readout in the end. Ideal for working in close when you can't afford to take your eyes off the circuit — one flash and you're ash!
3 ranges, 20V, 200V & 1000V. Battery powered.
Cat D-1445 .. .. $89.50

SPECIAL

VALUE PLUS! 'PACKSON' AM/FM ••• WITH CASSETTE RECORDER •••

You can record direct from the radio — no leads — or use the inbuilt condenser microphone. Cat A-4016

$49.90

LUXTONE AM/VHF RECEIVER

Same band coverage as above receiver, incredible value for such wide range. 'Luxtone' AM-FM-VHF receiver operates on AC/batteries, smart appearnace and comes complete with earphone and batteries. All solid state, robust construction.
Cat D-2840 .. .. $29.90

$29.90

VHF AIRCRAFT RADIO WITH A M BAND

$12.50

Handy pocket radio allows you to listen to international aircraft band (110-136 MHz). You can hear the control tower, automatic weather & landing information, aircraft approach and departure instructions, aircraft to aircraft etc. Ideal for flying students, flying schools etc. 9 V DC powered. Has AM broadcast band too.
Cat. D-2834.. .. .. $12.50

SAVE 33⅓%

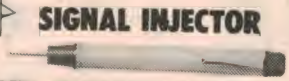
50¢ HIGH SPEED STEEL MINIATURE DRILLS FOR PC BOARDS:

Just right for component leads, no. 60 (.04in) won't be too sloppy or too tight.
Cat T-4820 .. .. $0.50

60¢

Or a little smaller: A no. 65 (.033in) ideal for small leads (especially IC pins).
Cat T-4825 .. .. $0.60

SIGNAL INJECTOR



$4.75

YOU CAN SERVICE ON THE CHEAP!

Very economic service signal injector puts out harmonics way up into the RF region. An invaluable service tool (at twice the price!)
Cat Q-1270 .. .. $4.75

* Translation: Hello readers, here's a go... Dick is Santa. Ho Ho Ho!

DICK SMITH ELECTRONICS GROUP
Head Office: Phone 439 5311. Telex AA20036. Cable Diksmit Sydney.
Mail Orders: P.O. Box 747, Crows Nest, N.S.W., 2065.
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Hunts Electronics, Toowoomba, Qld. Ph 32-6944
The Record Centre, Griffith, N.S.W. Ph 62-1577
Altronics Parts, Perth, W.A. Ph 28 1599.

Dealers prices may be slightly higher due to transport costs.

SHOP HOURS
Mon – Fri: 9 to 5.30
Sat: 9 to 12.

bankcard welcome here

POSTAL CHARGES

ORDER VALUE			CHARGE
$5	to	$9.99	$1.00
$10	to	$24.99	$1.50
$25	to	$49.99	$2.50
$50	to	$99.99	$3.50
$100 or more			$5.00

BY COMET FREIGHT : THE MINIMUM PACKING AND HANDLING CHARGE IS $1.00. WE DESPATCH "FREIGHT-ON" AND YOU PAY WHEN YOU RECEIVE THE GOODS.
FOR C.O.D. SEND $1.40 EXTRA PLUS $3.00 DEPOSIT.
MINIMUM MAIL ORDER AMOUNT IS $5.

Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Designing optimum-Q and small inductors

Optimum Q is achieved in an inductor when its length and diameter are equal. This table will serve as a guide when designing high-Q inductors for RF circuits. It gives maximum turns and inductance for various wire gauges when close-wound in a single layer.

Higher Qs will be obtained if the turns are spaced at one wire diameter. This results in half the turns and one quarter of the inductance listed in the table. Should an intermediate inductance or number of turns be desired, the factor, K, at the bottom of each column can be used for calculation from the formula L = KT.

Wire AWG		Diameter & Length (inches) 1/8	1/4	3/8	1/2	5/8	3/4	1
16	T			6	8	10	12	16
	L*			.233	.552	1.08	1.86	4.41
18	T		5	8	10½	13	15½	21
	L*		.108	.414	.950	1.82	3.11	7.60
20	T	3	6½	10	13	16½	19½	26
	L*	.0194	.182	.647	1.46	2.93	4.92	11.7
22	T	4	8	12	16½	20	24½	33
	L*	.0345	.276	.931	2.35	4.31	7.76	18.8
24	T	5	10	15	20½	25	30½	41
	L*	.0539	.431	1.46	3.62	6.74	12.0	29.0
26	T	6½	13	19½	25½	32½	38½	51
	L*	.091	.728	2.46	5.61	11.4	19.2	44.8
28	T	8	16	24	32	40	48	64
	L*	.138	1.10	3.72	8.83	17.2	29.8	70.6
30	T	10	20	30	40	50	60	80
	L*	.215	1.72	5.82	13.8	27.0	46.5	110
	K	.00215	.00431	.00647	.00862	.0108	.0129	.0172

*Inductance, L, is in microhenries.

When small inductors are needed, for RF chokes or HF filter networks, it is frequently convenient to wind them on composition (carbon) resistors. The table shows inductances for various wire sizes when close-wound on common resistor bodies. The resistor value should be above 4.7k for the low value inductances and above 47k for the higher values, unless low Q is desired.

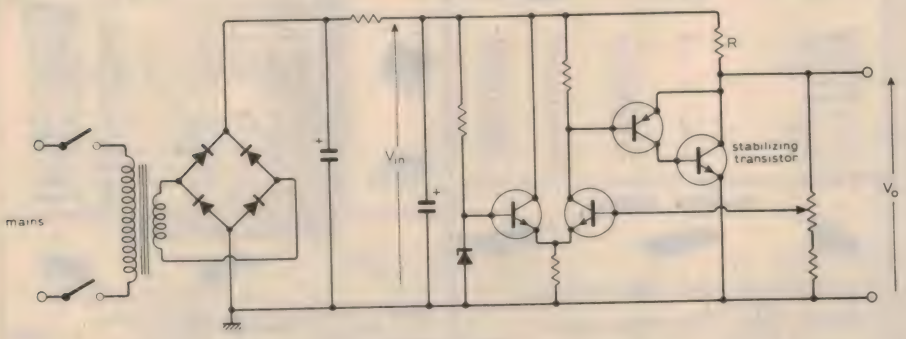
The number of turns listed leaves a little space at the end of the resistor body to file small notches in order to guide the coil wire down to the resistor lead while not allowing the coil turns to fall off the ends. Do not use wire-wound resistors.

(By R. E. Martin, in "Popular Electronics".)

Wire AWG		Resister Size ¼W	½W	1W	2W
20	T	3	7	11	14
	L*	.013	.097	.32	.63
22	T	4	8	13	17
	L*	.023	.13	.45	.92
24	T	5	10	17	22
	L*	.036	.20	.76	1.5
26	T	6	12	21	27
	L*	.051	.29	1.2	2.3
28	T	8	15	26	33
	L*	.092	.45	1.8	3.5
30	T	9	19	32	41
	L*	.12	.72	2.7	5.4
32	T	11	22	39	50
	L*	.17	.96	4.0	8.0
34	T	14	28	49	62
	L*	.28	1.6	6.3	12
36	T	18	34	60	77
	L*	.46	2.3	9.5	19

*Inductance, L, is in microhenries.

Shunt stabilised power supply



This circuit offers an improved power handling capacity over a simple zener stabilised circuit. It is short-circuit proof and less likely to damage delicate loads in the event of a fault in the supply. In many cases less power will be dissipated, by the regulating transistor, than in conventional series stabilisers. In the circuit shown, a feedback amplifier has been added to compare the output and zener voltages. The regulating transistor carries current equal to the difference between maximum and instantaneous currents. Therefore, if the load normally takes close to maximum current, the power dissipation will be low and a cheaper transistor may be used, particularly if the unregulated input voltage is very much larger than the required output voltage.

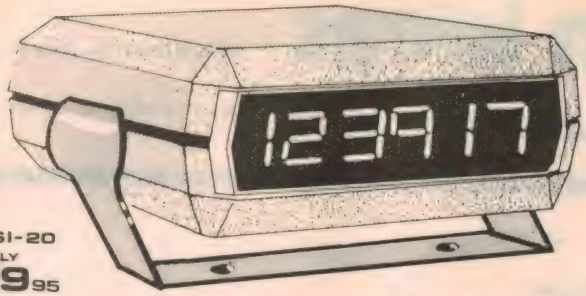
(By J. Suter, in "Wireless World".)

TTL decade counter divides by any integer

In many applications a pulse train must be divided by a fixed integer. For example, digital clocks often divide the line frequency by 50 to obtain a 1Hz output, and time-base generators divide a crystal oscillator frequency down to several stable low frequency outputs. If the integer is 10 or less, just one 7490 TTL decade counter can handle the division.

Usually frequency division in TTL circuits is accomplished by using binary counters and logic gates. To divide by

DIGITAL AUTO CLOCK



KIT SI-20
ONLY
$29.95
Plus $2.95 Airmail post/registration

Let your car, van, boat, caravan, truck, aircraft or any other vehicle join the Digital Revolution with our new Digital Auto Clock

FEATURES

9-14 VOLTS AC OR DC OPERATION • TWO-WIRE NON-POLARIZED POWER INPUT • BRIGHT .27" RED LED DISPLAY • DISPLAY BLANKS WHEN IGNITION TURNED OFF • 12 OR 24 HOUR TIME DISPLAY • QUARTZ CRYSTAL ACCURACY TO WITHIN .002% (ADJUSTABLE) • HIGH-TEMP. ABS PLASTIC CASE WITH MOUNTING BRACKET • CAN BE MOUNTED ON OR UNDER VEHICLE DASH • BATTERY BACK-UP FOR POWER FAILURE OR MOVING FROM HOUSE TO CAR ETC. • EASY TIME SETTING VIA HIDDEN SWITCHES IN FRONT OF CASE • VOLTAGE SPIKE AND NOISE SUPPRESSING CIRCUITRY.

Complete kit includes all parts, displays, etched and drilled PC Boards, Case and mounting bracket (less 9V transistor battery).

ALSO AVAILABLE WITH .36" DISPLAYS: KIT SI-204 . . . . . $33.95 + postage as above.

ALPHA MODEL DMM-1ER DIGITAL MULTIMETER KIT

SAVE $5.00

ONLY
$64.95
Plus $2.95 Airmail post/registration.

Measures:
- AC VOLTAGE
- DC VOLTAGE
- AC CURRENT
- DC CURRENT
- RESISTANCE

specifications

AC VOLTAGE
1 millivolt to 300 volts in four ranges. Input impedance: 10 megohms. Accuracy: ±1%. Frequency Response: 0 to full scale voltage between 40 and 100 Hz, 0 to 2.4 volts between 100 and 10,000 Hz, 0 to 1.5 volts between 10 Khz and 50 Khz.

RESISTANCE
1 ohm to 6 megohms. Accuracy: 0.1

CURRENT
DC current: 1 microamp to 2 amps. Accuracy: 1%. AC current: 1 microamp to 300 milliamps. Accuracy: 1%. AC Frequency Response: Same as for AC voltage.

DC VOLTAGE
1 millivolt to 600 volts in four ranges. Input Impedance: 10 megohms. Accuracy: 0.1% to 300V, 1% to 600V.

RESOLUTION
1 microvolt, 1 microohm, 1 ohm.

GENERAL
Readout: 3½ digit LED. Power Source: two AA penlight size batteries (Ni-Cad, alkaline or carbon zinc). Over-range Indication: display flashes when input exceeds value of range selected. Polarity Indication: automatic negative voltage and current indicated by display. Size: 5.1" x 3.4" x 1.5". Weight: 8 oz. Case: high impact Cycolac. Color: Red.

TEST LEADS AND BATTERIES NOT INCLUDED

4-DIGIT DECADE COUNTER

The Decade Counter is a basis for a wide variety of instruments.

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FND 510	C.A.	.50" red	1.60 ea.	5 S 7.55
FND 800	C.C.	.80" red	3.95 ea.	5 S18.75
FND 810	C.A.	.80" red	3.95 ea.	5 S18.75
DL 33MRR	C.C.	.11" x .3	1.45 ea.	5 S 6.75
DL 747	C.A.	.60" red	2.95 ea.	5 S14.25
XAN 654	C.C.	.60" grn	2.95 ea.	5 S14.25
XAN 664	C.C.	.60" red*	2.75 ea.	5 S12.95

* Denotes device has no decimal point.

C.C. Common Cathode C.A. Common Anode

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Submini Green	1	0.90	1.70	16.00
Mini Red	2	0.60	1.10	10.00
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Jumbo Red	3	0.80	1.50	13.50
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Jumbo Green	3	1.20	2.30	21.00

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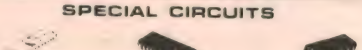
MM5316	4/6-digit, 12/24 Hr., 50/60Hz, Alarm, Snz., 40-pin dip	$4.50
MK50252	6-digit Alarm, Snz., 12 Hr/60Hz, 24 Hr/50Hz, 28-pin	$2.95
MK50381	4-digit direct LED drive, Alarm, Snz., Radio timer, non-multiplex, 40-pin	$6.95
PCB for MK50252, etched and drilled		$3.95
PCB for MK50381, etched and drilled, also accommodates 4 x FND70		$3.95

All clock chips supplied with data sheets

LINEAR IC's

308	Micro Power Op Amp	1.00	10/$ 9.00
380	2 Watt Audio Amp	1.00	10/$ 9.00
555	Timer	0.59	10/$ 5.50
565	Phase Locked Loop	1.75	10/$16.00
567	PLL Tone Decoder	1.39	10/$12.70
723	Voltage Regulator	0.55	10/$ 4.95
741	Op Amp	0.25	10/$ 2.25
709	Op Amp	0.25	10/$ 2.25
309K	5V/1A V. Regulator	1.00	10/$ 9.50
7805	5V Regulator TO-220	0.95	10/$ 9.00
7812	12V Regulator TO-220	0.95	10/$ 9.00
7815	15V Regulator TO-3	1.25	10/$11.50
7824	24V Regulator TO-3	1.25	10/$11.50
2102	1K Static RAM	2.25	10/$21.50

SPECIAL CIRCUITS



MK5002	4-digit decade counter/latch/decoder; 7-seg. and BDC outputs; 28-pin dip with data	$12.50
MK5005	4-digit decade counter/latch/decoder; 7-segment output only, 24-pin dip, with data	$ 9.50
MK5007	4-digit decade counter/latch/decoder with BCD outputs only, 16-pin dip with data	$ 7.00

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OPERATION OF 7490 IC AS A DIVIDE-BY-N COUNTER

DIVISOR N	INPUT PIN No.	OUTPUT PIN No.	EXTERNAL CONNECTIONS
2	14	12	PIN 2 OR 3 LOW PIN 8 TO PIN 2 PIN 9 TO PIN 3
3	1	8	
4	1	8	PIN 11 TO PINS 2 AND 3
5	1	11	PIN 2 OR 3 LOW
6	14	8	PIN 12 TO PIN 1 PIN 9 TO PIN 2 PIN 8 TO PIN 3
7	1	12	PIN 11 TO PIN 14 PIN 12 TO PIN 2 PIN 9 TO PIN 3
8	14	8	PIN 12 TO PINS 1 PIN 11 TO PINS 2 AND 3
9	14	11	PIN 12 TO PINS 1 AND 2 PIN 11 TO PIN 3
10	14	11	PIN 12 TO PIN 1 PIN 2 OR 3 LOW

N—i.e., to get one output pulse for every N input pulses—the logic gates are connected so that the counter is reset when the Nth pulse is counted. The most significant bit is used as the output, because it makes the high-to-low clocking transition only once for every N input pulses. If it is necessary to have an output pulse of a specific length, then a monostable may be triggered when the Nth pulse is detected.

The disadvantage of this division technique is that even for divisors less than 10, two ICs are required, a binary counter and a gate. But a pulse train can be divided by any integer between 2 and 10 by use of just one 7490 TTL decade counter IC, owing partly to its divide-by-2 and divide-by-5 stages and partly to its internal ANDed reset, which lets it reset only when both pin 2 and pin 3 are high.

The counter can be made to reset on any count from 2 to 10 by appropriate connections of the pins. The necessary interconnections for each value of N are shown in the table. For example, if division by 7 is desired, the 7490 is wired as shown in the figure. The input and output pulse trains for this configuration are also shown. If a larger division is required, it is only necessary to cascade several stages together, provided the divisor has factors that are all less than 10.

(By T. Durgavich and D. Abrams, in "Electronics").

Double-pole battery time switch

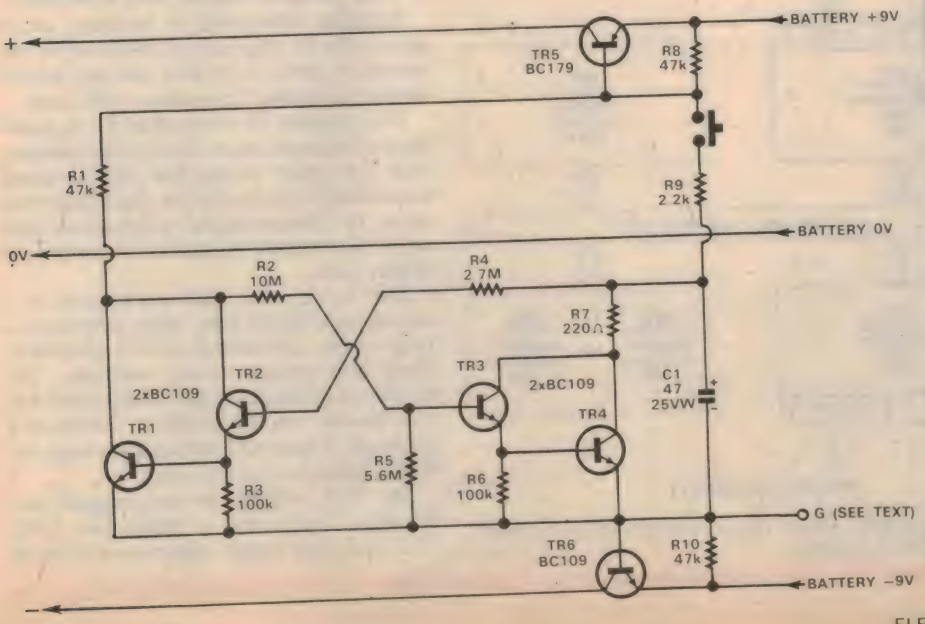
Designed to switch off battery-operated equipment automatically after about seven minutes, this circuit performs its function with a very low current drain on the battery. It was made up for use in the Solid State Multimeter described in the April, 1976 issue.

With a current drain of its own of only 350uA, it can switch at least 20mA to the equipment which it controls. When it switches off, the standby current it uses, less than 2uA, has a negligible effect on battery life.

Referring to the circuit, TR5 and TR6 perform the switching function. They receive their drive from the TR1, TR2 Darlington pair through the common collector load resistor. When the push-button is pressed, C1 charges via R9 and the base-emitter junctions of TR5 and TR6 turn on. As the charge across C1 increases, TR1, TR2 turn on by current through R4.

When the push-button is released, the charge across C1 slowly leaks away through R4 and continues to hold TR1, TR2 on, and in turn, hold TR5 and TR6 on. All this time, TR3, TR4 are biased off by the effects of R5 and the saturated TR1, TR2 pair. These conditions remain until the potential across C1 falls to about 1.5V.

(By Mr C. Christensen, 17 Centaur Street, Redcliffe, Qld 4020.)



The Mostek F8

Our survey of microprocessors continues this month with a detailed look at the Mostek F8 chip set, and the Mostek Evaluation Kit. This comes either as a fully assembled printed circuit board, or as a kit of parts.

by DAVID EDWARDS

The Mostek Corporation is second sourcing the Fairchild F8 microprocessor chip set, which was featured in last month's article. As noted in that article, the F8 microprocessor set is significantly different from other 8 bit designs we have considered. It is manufactured using N-channel Isoplanar MOS technology.

The F8 system is designed primarily for high-volume dedicated-use applications, and does not lend itself quite as readily as some other systems to one-off designs. However, this system can function with only two chips as a complete, fully viable microcomputer system, with 1k bytes of ROM program storage, 64 bytes of RAM, inbuilt clock and programmable timer, and 32 bits of programmable I/O.

The two chips which form the heart of the F8 system are the 3850, designated the CPU or central processing unit, and the 3851, program storage unit or PSU. In terms of chip area the latter device is primarily a mask-programmed ROM, organised as 1k bytes, which stores the program to run the system.

Conventional bus addressing has been avoided by moving all the memory address registers out of the CPU and into the PSU. The extra chip area so gained on the CPU chip has been used to incorporate a 64 byte scratchpad RAM and two bidirectional I/O ports.

On the other hand the mating 3851 PSU device contains a number of things which one doesn't find in a normal ROM, such as a program counter, a stack register, a data counter or indirect memory addressing register, and interrupt control logic. Quite apart from these it also provides two further 8-bit bidirectional I/O ports, and a programmable timer.

Fig. 1 shows how the basic two-chip F8 system is implemented. Fig. 2 shows a more advanced system, which has further features such as direct memory addressing (DMA). This allows peripheral devices, such as data inputs and outputs, direct access to the computer memory. This is achieved without any degradation in system performance, and has the advantage of using fewer machine cycles than would otherwise be the case.

There are only three programmable registers in the F8 CPU chip, apart from the 64-byte scratchpad. The three registers comprise an 8-bit primary accumulator, a 6-bit register used for indirect addressing of the scratchpad (called the ISAR), and a 5-bit status register.

To a certain extent the 64-byte scratchpad acts like a bank of 64 secondary 8-bit accumulators. The first 11 scratchpad bytes are directly addressable via some of the F8 instructions, while the rest are accessible through implied addressing via the ISAR register. However, scratchpad addresses 9-15 inclusive (decimal) are dedicated as buffers for the PSU addressing registers, so these will not usually be available for other purposes.

On the software side, the F8 has a repertoire of some 76 instruction, more than half of which use a single byte. Of the rest only three use 3 bytes, and the remainder 2 bytes. This allows some programs to be surprisingly short.

The F8 designers have achieved this economy by relying fairly heavily on implied addressing, where the data to be used in executing an instruction is not specified either directly or indirectly via an instruction operand, but is simply implied by the type of instruction.

In all there are some 15 accumulator instructions, 12 branch instructions, 8 memory reference instructions, 13 address register instructions (including jump to subroutine and return), 15 scratchpad register instructions, and 13 miscellaneous instructions.

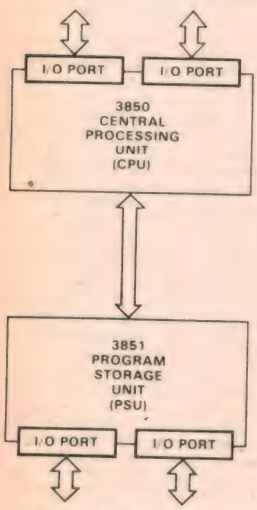
Included in the F8 instruction set are a number of powerful immediate instructions, including ADD, AND, COMPARE (2's complement subtraction), EX-OR, LOAD and OR, together with a "call to subroutine immediate" and a "load data counter immediate". There is also a "short" LOAD immediate instruction, which is only a single byte long, and used to load the accumulator with 4-bit data.

Readers interested in learning more about the F8 chip-set are referred to the previous article in this series, which appeared in the November 1976 issue.

The Mostek F8 Evaluation Kit is available in Australia from Namco Electronics. Like the other evaluation kits we have looked at, it is intended to allow potential users to gain practical experience and undertake simple program development at low cost.

The kit comes well packaged in a strong cardboard box, and comprises a ring binder containing device specifications and programming manuals. The binder also includes the completed circuit board, stapled inside a conductive package. A separate additional programmer's guide is also included.

The PCB, which can be plugged into an edge connector, contains the CPU, PSU and SMI (static memory interface)



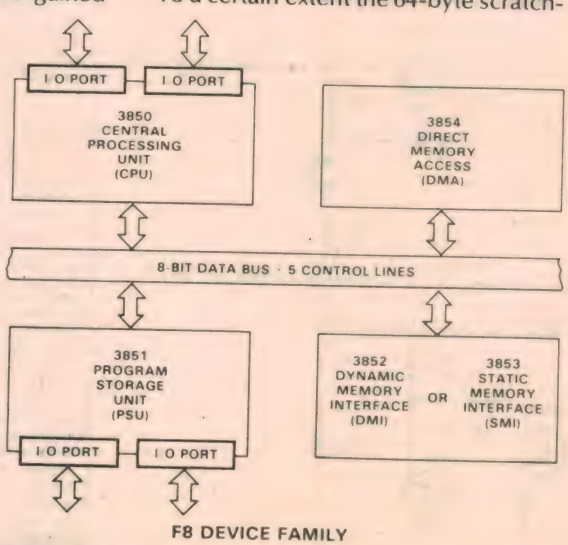


Fig. 1 at left shows a minimal 2-chip F8 system, while Fig. 2 at right shows a more elaborate system with further RAM and DMA facilities.

chips, as well as 1k of RAM, and a full duplex 20mA loop teleprinter interface. A 2MHz crystal is included, so no adjustments are required prior to switch-on. Power requirements are 12VDC at 120mA and 5VDC at 750mA.

The Mostek debug program, called the Designers Development Tool (DDT-1) is resident in the PSU, and occupies the first 1k of memory space. The 1k of RAM appears in the second 1k of memory space, which because of simplified addressing logic also becomes duplicated in the succeeding 1k bytes.

DDT-1 provides basic facilities for development of user programs, as well as routines for teleprinter IOT servicing. DDT-1 allows the operator to insert a breakpoint in his or her program, copy a block of memory into another area, dump memory into and load from paper tape, execute a program starting at any desired memory address, carry out hexadecimal arithmetic, examine and alter memory locations, examine and modify the I/O ports, and to type out a block of memory.

Namco Electronics kindly made available to us a sample evaluation kit, which we were able to "fire up" and try using a Lear Siegler ADM-3 Video Terminal, which was also on hand at the time for review.

DDT-1 proved to be quite easy to use, although, in common with most other simple debug programs, it uses a carriage return as a command terminator. This caused no problems on the video-terminal, but it does tend to cause a teleprinter to consume a large amount of paper. Our only real criticism is that DDT-1 does not seem to be protected against erroneous keyboard entries.

This is the Mostek F8 evaluation kit, comprising PCB, a binder with user manuals, and a programmer's guide. The CPU clock is crystal controlled.

For example, accidental type-in of the letter O instead of a zero when feeding in a hexadecimal address appears to produce unpredictable results. Sometimes part of the user's program can be altered, which can be rather annoying! It would be desirable for DDT-1 to be modified so that it checks for valid hexadecimal characters in the keyboard input, and throws out invalid characters with a query.

Getting to grips with programming proved to be quite straightforward, as Mostek have provided a fully explained sample program. For comparison with other systems, I have written a version of Jim Rowe's "answer-back" program, which is reproduced on these pages.

The first point of interest about this program is the amount of initialization that is required at the start, mainly to use the IOT routines resident in DDT-1. Note also the use of the auto-incrementing ADD BINARY (AM) instruction together with the branch-on-zero (BZ) instruction in the ANSWER loop, to provide exit from the loop at the end without the need for a separate pointer.

Since the DDT-1 teleprinter output routine always responds with a line feed as well as a carriage return when a carriage return is sent, no line feeds are needed in the answer.

Overall, we found the Mostek F8 Kit to be easy to use, and would recommend it to those interested in using the F8 system. It is suitable as either an evaluation system, or as a low cost development tool.

The D.I.Y. kit is available for $248.34 plus tax, while the completely assembled version sells for $300.00 plus tax. Enquiries should be directed to Namco Electronics, 239 Bay Street, North Brighton, Victoria 3186, or to Namco Electronics, 69 Archer Street, Chatswood, NSW 2067.

```
ANSWER-BACK PROGRAM FOR MOSTEK F8 EVALUATION KIT
D. EDWARDS, ELECTRONICS AUSTRALIA 19/10/76

0400 20 FF        INIT,LI   FF          /LOAD AC WITH FF
0402 0B             LR      IS,A        /INITIALIZE ISAR TO 3F
0403 54             LR      4,A         /COPY AC INTO REG 4
0404 34             DS      4           /DECREMENT REG 4 TO FE
0405 56             LR      6,A         /COPY AC INTO REG 6
0406 71             LIS     H'1'        /LOAD AC WITH 01
0407 B6             OUTS    6           /TRANSFER AC TO TIMER PORT TO ENABLE EXT INT
0408 1B             EI                  /ENABLE I/O ROUTINES
0409 2C 03 F3   START,PI    03F3        /CALL TTYIN SUBROUTINE
040C 4C             LR      AS          /COPY CHAR INTO AC FROM RS
040D 25 0D          CI      'OD'        /COMPARE WITH CR
040F 84 06          BZ      'MESSAGE'   /JUMP TO MESSAGE IF CR
0411 28 03 5D       PI      035D        /SEND CHAR TO TTYOUT SUBROUTINE
0414 90 F4          BR      START       /LOOP BACK TO START
0416 2A 04 23 MESSAGE,DCI   0423        /LOAD DC WITH MESSAGE ADDRESS
0419 70         ANSWER,CLR              /CLEAR AC
041A 88             AM                  /ADD CHAR TO AC AND INC DC
041B 84 ED          BZ      START       /LOOP BACK TO START
041D 5C             LR      S,A         /COPY CHAR INTO RS
041E 28 03 5D       PI      035D        /SEND CHAR TO TTYOUT SUBROUTINE
0421 90 F7          BR      ANSWER      /LOOP BACK TO ANSWER
0423 0D 47 4F                           /START OF ANSWER BUFFER
0426 20 41 57
0429 41 59 2C
042C 20 49 27
043F 4D 20 42
0432 55 53 59
0435 21 0D 00                           /ANSWER MUST END WITH A ZERO BYTE
```

Here is the author's version of our "answer-back" program, re-written for the Mostek evaluation kit and the DDT-1 teleprinter subroutines.

The continuing saga of microprocessors – and other electronic components:

DEADANT HILLS

The story so far: Clancy of the overflow was in a bit of a binary. The chips were down – pins up. That nice piece of software, Sign Bit, said she wanted to shift. She had given him the jump. Clancy felt his control section needed de-bugging, but his diagnostic routine was ruffled. Maybe his firmware was beginning to flag and he had lost his effective address. It was a hexadecimal problem and only the index register could give the right readout. Would Clancy miss the bus, forget his micro instructions, or would he get on his microcycle and turn into a true executive? Now forget the jargon and read on:

For microprocessors the bit code is TOTAL. Store it and ring us for full readout.

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The Sphere system

Of the many microcomputer systems based on the Motorola 6800 microprocessor chip family, perhaps those which have aroused the most interest are the systems produced in the US by the Sphere Corporation. No doubt this is because Sphere has integrated their basic system with a video display and keyboard, and is selling the resultant package for little more than the cost of a basic video terminal.

In appearance, a basic Sphere system is very similar to a conventional video terminal. It has a video screen and a full ASCII-type keyboard, mounted in a well-styled and solid terminal case. But inside the case is a complete microcomputer as well as the display and keyboard.

The Sphere 320 system comprises a total of four modules: a CPU module, a CRT interface module with video monitor assembly, a keyboard module complete with keyboard, and serial interface module.

The CPU module provides a complete 6800 microcomputer system, on a single PCB measuring 200 x 250mm. It includes 1k bytes of PROM with a resident debug and monitor program, 4k bytes of RAM for user programs, a bidirectional 8-bit I/O port, 2 interrupt lines, serial interface port, and fully buffered system bus.

The CRT interface module is on a single PCB of the same size as the CPU. It is designed to provide a display of 16 lines, each 32 characters long, using a standard 5 x 7 dot matrix character set. The module includes its own 512-byte RAM for refresh servicing, so that the CPU can operate at full speed.

The CRT module has both video and modulated RF outputs. Its output is normally fed directly to the inbuilt video monitor, but can be directed to an external monitor or TV receiver if desired. Up to 8 CRT modules can be operated in a system if desired.

The keyboard module has a full ASCII keyboard, together with the appropriate encoding logic.

Finally the serial interface module or "SIM" provides flexible serial interfacing facilities, to allow the system to communicate with a variety of serial peripheral devices. These include single and dual tape cassettes, a modem, or a cassette and modem combination.

All of these fit into the basic Sphere case, measuring 460 x 320 x 485mm. The only external item is the power supply, which is also supplied.

For those wanting a more powerful system than the 320, Sphere also markets the model 340. This provides all of the facilities of the 320, together with two further modules: a memory board with 16k of additional memory, and a parallel I/O module.

The 340 memory board is the same size as the CPU and CRT modules. It has provision for a total of 16k of dynamic RAM devices, and in the 340 system it comes fully populated. However further modules are also available, populated in any desired 4k increment from 4k to 16k.

The parallel I/O module comes again on a PCB measuring 200 x 250mm. It has four PIA devices, providing a total of 64 bits of parallel I/O interfacing, together with handshaking logic for interfacing to peripheral devices such as a line printer and floppy disc drive.

To mate with the more powerful 340 system, Sphere market both a line printer unit and a dual floppy disc drive. The line printer is a bidirectional impact printing mosaic type, operating at a rate of 110 chars/sec and 65 lines/minute. It uses tractor-fed paper, and prints in 80 columns.

The dual floppy disc unit uses IBM-type initialised diskettes, and provides storage of 256,256 bytes per diskette.

Software available for the 340 system includes extended BASIC, and a disc operating system.

Literature supplied with the Sphere 320 and 340 systems is at present rather sparse, consisting mainly of basic information on the 6800 microprocessor system. There is very little in the way of operating or programming information on the Sphere systems as supplied; however we understand that this deficiency will be rectified in the very near future.

In view of their availability as compact, fully assembled systems which are easily expanded as required, both the 320 and 340 Sphere systems seem likely to be of considerable interest in Australia.

The sole distributors for Sphere in this country are Paradio Electronics Pty Ltd, of 7A Burton St, Darlinghurst, NSW, 2010, who currently have 320 systems in stock.

(J.R.)

Apart from the power supply, the Sphere 320 is fully self-contained.

Software/Firmware developments—1

SC/MP gets Tiny-BASIC

If you've tended to scorn microcomputer systems because of the need to program in machine or assembly language, think again. National Semiconductor is releasing shortly a Tiny-BASIC interpreter for its SC/MP systems. It will be sold resident in 4k-bytes of PROM, on a PC card. Plug in the card, and you can have programs running in Tiny-BASIC within the hour!

by JAMIESON ROWE

Although microcomputers haven't been around for very long as yet, already many of the people using them have begun to show interest in the possibility of programming in one of the problem-orientated or "higher" languages like FORTRAN or BASIC. No doubt these thoughts tend to be generated most often when one is slogging through a program written in hexadecimal code!

Of course in order to be able to run programs written in a problem-orientated language, one needs to have them translated into language which the computer can understand. At present this must be done in one of two ways.

One is to use a compiler, which is itself a computer program. When fed into the machine, the compiler will take your "source code" program as written, and produce from it an "object code" equivalent in machine language. It is this version which you then feed into the machine to get your program running.

The other way is to use an interpreter, which again is also a computer program. But unlike a compiler, an interpreter doesn't produce a separate object code version of your program. Instead it must be put in the machine alongside your program, which it interprets into machine language and executes all at the same time.

Which approach is used depends mainly on whether you have a compiler or an interpreter program available, although an interpreter tends to be a little more convenient because it allows faster program development.

The problem with either approach is that both compilers and interpreters tend to be rather long. They are rather tricky and tedious to write, and when written they need quite a deal of computer memory. The latter is especially true with interpreters, which are loaded into memory along with the source program.

Because of the requirement for a fairly large memory, until recently languages like FORTRAN and BASIC have mainly been available only on larger computers.

In the last couple of years, however, a number of people working with various microcomputer systems have come up with interpreters capable of fitting into small systems, and which provide a limited sub-set of the full original BASIC language. Naturally enough the language provided by these interpreters has quickly become known as "Tiny-BASIC".

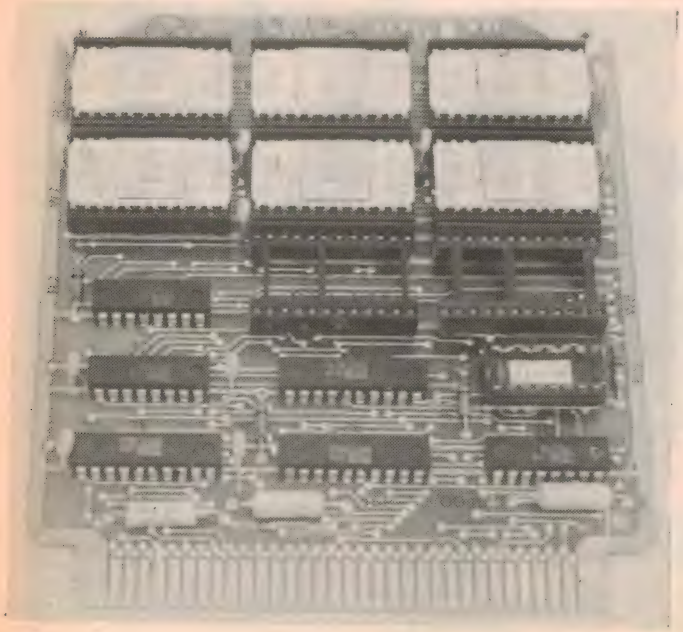
Now National Semiconductor has announced that a Tiny-BASIC interpreter will very shortly become available for its SC/MP microprocessor systems. National's Australian subsidiary, NS Electronics, expects to have it available by late January. It will be sold as a product package which comprises the interpreter itself resident in 4k of PROM on a plug-in PC card, a 2k static RAM card for the user's source program, and a user's manual. The complete package should sell for around $305 plus tax, where applicable. Those who already have SC/MP systems with at least 2k of RAM may also be able to buy just the interpreter and the manual, if they wish, by quoting the serial number of their existing RAM board.

National has called its version of Tiny-BASIC "NIBL", which stands for National Industrial BASIC Language. This is meant to emphasise that they see its applications not only in educational and hobby computing, but also and perhaps more importantly in industrial control situations.

Like most other Tiny-BASIC interpreters, NIBL is not fast. A program written in NIBL executes somewhere between 1000 and 2000 times more slowly than an equivalent program written in machine or assembly language. But this can still be fast enough for most human interfaces, and for slow real-time control applications.

And the point is that NIBL lets you write programs and get them running very much more easily and quickly. It also provides "instant" error messages during program execution, to help you in debugging. And it lets you execute single instructions in real-time conversational mode, if you wish.

Naturally enough, NIBL doesn't provide all of the facilities of full BASIC—after all, it has to fit into only 4k bytes of memory. But it does provide a very



This is the pre-release version of NIBL, which was in only 3k bytes of PROM. The final version is in 4k bytes, with the PCB having eight of the PROMs instead of six.

```
10 PRINT "HI, I WORK OUT FACTORIALS."
20 PRINT "WHAT NUMBER WOULD YOU LIKE";
30 INPUT N
40 LET F=1
50 IF N<=1 THEN GOTO 90
60 LET F=F*N
70 LET N=N-1
80 GO TO 50
90 PRINT "ITS FACTORIAL IS",F
91 PRINT "DO YOU WANT TO WORK OUT ANOTHER (1=YES,0=NO)";
92 INPUT A
93 IF A=1 THEN GO TO 20
100 END
```

```
>RUN
HI, I WORK OUT FACTORIALS.
WHAT NUMBER WOULD YOU LIKE? 6
ITS FACTORIAL IS 720
DO YOU WANT TO WORK OUT ANOTHER (1=YES,0=NO)? 1
WHAT NUMBER WOULD YOU LIKE? 7
ITS FACTORIAL IS 5040
DO YOU WANT TO WORK OUT ANOTHER (1=YES,0=NO)? 0
```

```
10 PRINT "HI! I WILL THINK OF A NUMBER BETWEEN 0 AND 255."
20 PRINT "WHEN I HAVE,TRY TO GUESS ITS VALUE. (I WILL HELP)"
30 LET B=1
40 LET A=@B
50 PRINT "OK, I HAVE A NUMBER"
60 PRINT "WHAT IS YOUR GUESS";
70 INPUT C
80 IF C=A THEN GOTO 140
90 IF C>A THEN GOTO 120
100 PRINT "TOO SMALL. NEXT GUESS";
110 GO TO 70
120 PRINT "TOO BIG. NEXT GUESS";
130 GO TO 70
140 PRINT "YOU GUESSED IT!!!   LET'S PLAY AGAIN."
150 LET B=B+1
160 GO TO 40
170 END
```

```
>RUN
HI! I WILL THINK OF A NUMBER BETWEEN 0 AND 255.
WHEN I HAVE,TRY TO GUESS ITS VALUE. (I WILL HELP)
OK, I HAVE A NUMBER
WHAT IS YOUR GUESS? 200
TOO BIG. NEXT GUESS? 180
TOO SMALL. NEXT GUESS? 196
YOU GUESSED IT!!!   LET'S PLAY AGAIN.
OK, I HAVE A NUMBER
WHAT IS YOUR GUESS? 128
TOO BIG. NEXT GUESS? 64
TOO BIG. NEXT GUESS? 32
TOO BIG. NEXT GUESS? 0
TOO SMALL. NEXT GUESS? 16
YOU GUESSED IT!!!   LET'S PLAY AGAIN.
OK, I HAVE A NUMBER
WHAT IS YOUR GUESS? 128
TOO BIG. NEXT GUESS? 0
TOO SMALL. NEXT GUESS? 64
TOO BIG. NEXT GUESS? 32
TOO SMALL. NEXT GUESS? 45
TOO SMALL. NEXT GUESS? 56
TOO BIG. NEXT GUESS? 60
TOO BIG. NEXT GUESS? 58
TOO SMALL. NEXT GUESS? 54
YOU GUESSED IT!!!   LET'S PLAY AGAIN.
OK, I HAVE A NUMBER
WHAT IS YOUR GUESS?
! 7 AT 70
>
```

Here are the two simple Tiny-BASIC programs which the author wrote to try out the pre-release version of NIBL. One works out factorials, the other is a number game.

useful subset. Here's a summary of what you get:

Valid statement forms include INPUT (for numbers only), LET, GO TO, GO SUB and RETURN, IF THEN, and PRINT. There is also a CALL statement, to allow calling machine-language subroutines. The latter facility is very valuable, of course, because it will allow NIBL to be expanded.

The final version of NIBL may also have the ability to interpret DO . . . UNTIL statements, if PROM space permits.

Program control statements provided are LIST, RUN, END, and CLEAR. The first of these may be used to list either the whole program, or alternatively a single line. An inbuilt editor allows lines to be replaced, and also additional lines added as required. All that is necessary for correct execution is that lines are numbered consecutively between 1 and 32, 767.

If statement lines begin with a number, NIBL stores them away as a program for deferred execution. If a statement is not numbered, NIBL executes it immediately upon entry (following the user terminating the line with a carriage return).

NIBL is only capable of performing integer arithmetic, on numbers within the range from −32,768 to +32,767. It provides the four basic arithmetic functions, represented by the symbols +,−,* and /, together with the logic operators AND, OR and NOT, and a 16-bit random number generator function called by the label RND. Constants may be expressed in either decimal or hexadecimal.

Up to 26 variables may be used in a NIBL program, using single alphabetic characters as labels (A-Z inclusive). Parenthesis is permitted, and subroutines may be nested to 16 levels.

All of the normal relational operators are provided, including equals, greater than, less than, greater than or equals, less than or equals, and not equal to.

NIBL also provides an operator of indirection, symbolised by the "at" or "@" sign. When placed immediately preceding a variable this causes the variable to be interpreted as a decimal address in SC/MP memory space. If A is a variable with value 256, the statement LET B=@A gives variable B the value equal to the data byte in decimal memory location 256.

What is NIBL like in practice? Well, at the time of writing the final version was not yet available in Australia, but thanks to NS Electronics I was able to try an earlier pre-release version. This was in only 3k of PROMs, and didn't have some of the features which will be in the full 4k version—like the RND function or the logic functions, or the CALL statement.

However it was certainly very interesting to try the smaller version out, with one of the SC/MP LCDS systems. Even though its facilities were rather limited, it was still very nice to be programming at a higher level of abstraction and be able to make corrections on-line.

In fact after having got a couple of simple programs up and running, it was with surprise that I noticed the time: less than an hour after the NIBL card had been plugged in and the system turned on!

As the two programs might be of interest to readers, I have reproduced them on these pages. In each case the program itself is listed first, followed by a sample of the execution.

As you can see, the first program is a very simple one which calculates the factorial of a number fed in from the keyboard. It prompts the user for a number, prints out the answer and then asks if the user wishes to work out another. A negative reply causes it to halt.

Incidentally, this little program soon comes up against the inability of NIBL to cope with numbers greater than 32,767. In fact the largest number it can find the factorial for is 7; 8 causes overflow.

The longer program is a simple number guessing game. As the pre-release version of NIBL didn't have the RND function, I had to use the indirect operator to generate pseudo-random numbers by fetching instruction bytes from NIBL's own PROMs! As you can see, this worked fairly well.

The program can be quite good fun, giving you a taste of the appeal in computer games.

Of course with the final version of NIBL, it will be possible to run games like this which will be rather more satisfying, using the RND function to generate less predictable numbers. In fact quite a few games have been written in Tiny-BASIC, and should be capable of being run with NIBL.

In short, NIBL seems to be very good news for SC/MP users.

You'll be able to order NIBL from NS distributors throughout Australia. For further information, contact NS Electronics at either Cnr. Stud Road and Mountain Hwy, Bayswater, Victoria 3153, or 2-4 William Street, Brookvale, NSW 2100.

Software/Firmware development—2

A Text Editor for SC/MP

Here is a symbolic text editor program which the author has written for National Semiconductor's SC/MP low cost development system. It provides all the basic text editing functions to let you prepare programs for assemblers, compilers, etc. You will be able to buy it resident in 1k bytes of PROM and ready to go, or, alternatively, it can be fed into your system via tape or cassette, and run in RAM.

by JAMIESON ROWE

If you've ever tried punching up a paper tape of a program in assembly or problem-orientated language using a teleprinter on "local", you'll know just how frustrating it can be. Even if you are extremely careful it seems to be impossible not to make a few errors, and Murphy's Law always seems to ensure that you rarely discover these until you have typed in at least three more lines!

Of course if you realise that you made an error immediately after having done it, you can use the back-space facility and delete the wrong character(s) with the rubout key. But if you don't discover an error until later on, you are forced to either perform cut-and-paste surgery on the tape, or try stop-and-go editing of the tape while punching a new "clean" version.

Preparing long problems in this way can be very tedious and time consuming. Small wonder, then, that the people working on minicomputers and larger machines have for years been using the computer itself to make the job easier and faster. This is done by using a software utility program known as a symbolic text editor.

Using such a program, you type your own program text into a section of the computer's memory which is set aside as the "buffer". Then with the text in the buffer, the editor lets you change lines, delete lines, insert extra lines at any desired point, inspect lines or groups of lines, and finally either type out a listing or punch out a clean tape (or both).

In short, a text editor program can be a very useful item of software, and it is well worth having one even on small microcomputer systems. The only trouble is that not too many microcomputers have been provided with editor programs as yet, particularly the systems based on the more recent microprocessor chips.

To help alleviate this situation, I have written a text editor program for the National Semiconductor SC/MP lowcost development system, as described in our October issue. I chose this system because at present the SC/MP chip and its systems appear to be growing fastest in popularity, particularly in the hobby area.

The editor program itself is written in SC/MP machine language, and occupies 864 bytes of memory. It uses the 256-byte RAM in the LCDS system base as a stack and line address buffer, but can use RAM memory at any other location in SC/MP memory space for its text buffer. The larger the available RAM, the more text the editor can handle at one time.

I have arranged for the editor to be available from NS Electronics distributors, written into a pair of MM5204 512-byte PROMs. With the PROMs plugged into the correct locations on a SC/MP ROM card which is programmed for the appropriate address range (hex. 3000-3FFF), you will then have the editor permanently resident in your system, and available at any time merely by calling it at its starting address (hex. 3C00).

Alternatively, you can run the editor in RAM memory, loading it in each time you need it by means of a punched paper tape or cassette. I am reproducing a full hexadecimal listing of the program on these pages, to allow you to do this if you wish. The four-digit numbers at the start of each line are addresses; as you can see the program runs from 3C00 to 3F5F, inclusive.

Note that if you do elect to run the editor in RAM, you will need at least one 2k-byte RAM card. This will give you 1k of RAM left for the text buffer—enough for small text slabs, but barely good enough for serious work. With the editor in PROMs, even a single RAM card gives you a full 2k for the text buffer, which is very much more practical.

When the editor is called, it announces itself and then asks you to give the available text buffer range in memory. This must be supplied as two hexadecimal numbers, separated by a non-hex character such as a space or hyphen. Leading zeroes are not required, but the second number must end with a carriage return.

The editor then enters its command mode, signalling this by ringing the bell. The user may then type in a command letter, followed by a carriage return. If text is to be fed in via the keyboard, the command letter "A" is appropriate, while "R" tells the editor to read in a previously punched tape via the reader.

```
SC/MP SYMBOLIC EDITOR PROGRAM.
WRITTEN BY J.ROWE, ELECTRONICS AUSTRALIA
FOR SC/MP L.C.D.S. SYSTEMS

BASIC COMMANDS AND THEIR FUNCTIONS:
(THE CLOSING BRACKET ")" SYMBOLISES A CARRIAGE RETURN)

COMMAND                 FUNCTION

A)                      APPEND LINES TO BUFFER
R)                      READ TAPE INTO BUFFER
L) , ML) , M,NL)        LIST ALL LINES, OR LINE M, OR LINES M-N
MC) , M,NC)             CHANGE LINE M, OR LINES M-N
MI)                     INSERT LINE OR LINES BEFORE LINE M
MD) , M,ND)             DELETE LINE M, OR LINES M-N
K)                      KILL TEXT IN BUFFER
P) , MP) , M,NP)        PUNCH ALL LINES, LINE M, OR LINES M-N
B) , MB) , M,NB)        AS FOR PUNCH, BUT PUNCHES A BELL CHAR
                        AT END OF TEXT
/                       EDITOR PRINTS NUMBER OF LINES CURRENTLY
                        HELD IN TEXT BUFFER, IN DECIMAL
BELL                    WHEN IN TEXT MODE, RETURNS EDITOR TO
                        COMMAND MODE
(M AND N REPRESENT DECIMAL LINE NUMBERS)
```

Here is the basic command set of the editor, showing the various command letters, the possible arguments for each, and their functions. In text mode, a percent sign acts as a backspace.

```
3C00 04 C4 77 36 C4 FF 32 C4 7B 37 C4 16 33 3F 3F 07
3C10 C4 4F 33 3F C6 01 CA F1 C6 01 CA EF 3F C6 01 CA
3C20 EF C6 01 CA ED C4 00 CA F9 C2 F0 CA F8 C2 EF CA
3C30 F7 C4 7A 37 C4 E1 33 C4 07 3F C4 0D 3F C4 0A 3F
3C40 C4 00 CA F4 CA F3 CA F2 C4 7A 37 C4 90 CA F1 33
3C50 3F D4 7F 01 C4 3F 35 C4 2B 31 C5 03 98 3B 60 9C
3C60 F9 C1 FE CA F6 C1 FF 31 C2 F6 35 C2 F9 03 FA F3
3C70 94 02 90 12 C2 F9 03 FA F2 94 02 90 09 C2 F2 98
3C80 10 03 FA F3 94 0B C4 7A 37 C4 E1 33 C4 3F 3F 90
3C90 A9 3F D4 7F E4 0D 9C EE 3D 40 D4 70 E4 30 98 19
3CA0 40 E4 2F 9C 09 C4 3E 35 C4 B2 31 3D 90 8C 40 E4
3CB0 2C 9C D3 C4 01 CA F4 90 8F 40 D4 0F CA F5 C2 F4
3CC0 9C 04 C2 F3 90 02 C2 F2 02 01 40 70 01 70 70 01
3CD0 40 70 F2 F5 01 C2 F4 9C 05 40 CA F3 90 D9 40 CA
3CE0 F2 90 D4 35 CA F6 31 CA F5 C2 F7 CA E9 C2 F8 CA
3CF0 EA C2 F1 E4 84 98 09 C4 7A 37 C4 E1 33 C4 0A 3F
3D00 C4 7A 37 C2 F1 33 C2 EE 02 F4 01 E2 F8 98 53 C2
3D10 F8 35 C2 F7 31 3F D4 7F 01 40 E4 0A 98 1D 40 E4
3D20 07 98 3F 40 E4 25 9C 04 C5 FF 90 0F 40 98 0C E4
3D30 7F 98 08 40 E4 0D 98 01 40 CD 01 C4 77 35 CA F8
3D40 C2 F3 02 F2 F3 31 CA F7 40 E4 0D 9C B6 C2 E9 C9
3D50 00 C2 EA C9 01 C2 F9 E4 74 98 07 C2 F6 35 C2 F5
3D60 31 3D C4 3C 35 C4 30 31 C4 90 CA F1 3D 08 08 08
3D70 C4 80 90 02 C4 01 CA F1 C2 F3 9C 0A C4 01 CA F3
3D80 C2 F9 CA F2 90 08 C2 F2 9C 04 C2 F3 CA F2 C4 E1
3D90 33 C4 0A 3F C2 F1 98 15 C4 7A 37 C4 88 33 3F C4
3DA0 E1 33 C4 C0 CA F6 C4 00 3F AA F6 9C F9 C4 77 35
3DB0 C2 F3 02 F2 F3 31 C1 00 CA F6 C1 01 35 C2 F6 31
3DC0 C5 01 98 03 3F 90 F9 C4 0D 3F C4 0A 3F C2 F3 E2
3DD0 F2 98 04 AA F3 90 D6 C2 F1 98 1A 94 03 C4 07 3F
3DE0 C4 C0 CA F6 C4 00 3F AA F6 9C F9 C4 7A 37 C4 88
3DF0 33 3F C4 E1 33 C4 3C 35 C4 39 31 3D 08 08 08 08
3E00 C2 F2 9C 06 C2 F3 98 35 CA F2 BA F3 C2 F2 E2 F9
3E10 98 20 AA F3 AA F2 C4 77 35 C2 F2 02 F2 F2 31 C4
3E20 77 37 C2 F3 02 F2 F3 33 C1 00 CB 00 C1 01 CB 01
3E30 90 DA C2 F3 CA F9 C4 3C 35 C4 30 31 3D C4 3C 35
3E40 C4 83 31 3D C2 F3 98 F5 C2 F2 9C F1 C4 77 35 C2
3E50 F3 02 F2 F3 31 C1 00 CA EB C1 01 CA EC C4 3C 35
3E60 C4 E2 31 3D C2 F9 CA F2 AA F9 C4 77 35 C2 F2 02
3E70 F2 F2 31 C1 00 C9 02 C1 01 C9 03 C2 F2 E2 F3 98
3E80 04 BA F2 90 E5 C2 EB C9 02 C2 EC C9 03 AA F3 90
3E90 BB C2 F2 9C 06 C2 F3 98 A4 CA F2 C4 3C 35 C4 E2
3EA0 31 3D C2 F3 E2 F2 98 04 AA F3 90 EF C4 3C 35 C4
3EB0 30 31 3D C4 00 CA F6 CA F5 CA F4 C2 F9 02 F4 9C
3EC0 94 05 C2 F9 01 90 03 01 AA F6 40 02 F4 F6 94 02
3ED0 90 05 01 AA F5 90 F3 40 02 F4 FF 94 02 90 05 01
3EE0 AA F4 90 F3 C4 7A 37 C4 E1 33 C4 3D 3F C2 F6 98
3EF0 03 C4 31 3F C2 F5 98 03 DC 30 3F C2 F4 DC 30 3F
3F00 C4 3C 35 C4 39 31 3D 0D 0A 45 44 49 54 4F 52 20
3F10 52 45 41 44 59 2E 0D 0A 47 49 56 45 20 42 55 46
3F20 46 45 52 20 52 41 4E 47 45 3A 00 41 3F 4A 52 3F
3F30 46 4C 3D 75 43 3E 90 49 3E 43 44 3D FF 4B 3C 24
3F40 50 3D 73 42 3D 6F 00 C4 84 90 02 C4 90 CA F1 C2
3F50 F9 CA F3 AA F3 C4 3C 35 C4 E2 31 3D AA F9 90 EF
```

Use this complete hexadecimal listing of the program if you wish to prepare a paper tape or cassette to run the editor in RAM, or if you are able to burn your own PROMs.

Once the text is in the buffer, you can edit it using the commands shown in the table. Note that the L, C, I, D, P and B commands may all have arguments, to specify individual lines or a group of lines. In fact the I command must have one argument, to indicate where the insertion is to take place.

The argument number or numbers must precede the command letter. Thus to list lines 12 to 15, for example, you simply type 12, 15L followed by a carriage return.

To change a line, say line 34, you simply type 34C, a carriage return, and then type in the new line text. Similarly to insert a new line or lines before an existing line, say line 17, type 17I followed by a carriage return and then type in the extra lines. To delete lines, say lines 20, 21 and 22, type 20, 22D and then a carriage return.

A single argument implies that the command should affect only the one line. Two arguments imply that the command should affect all lines between the two corresponding lines, inclusively. Thus 15, 20C implies that six new lines are to be fed in, replacing the existing lines 15, 16, 17, 18, 19 and 20.

(Continued on page 133)

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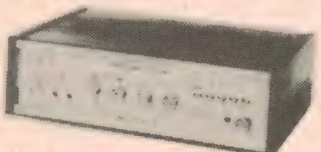

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Classical Recordings

Reviewed by Julian Russell

Wagner—Tristan and Isolda: "glorious"

WAGNER—Tristan and Isolda. Complete Music Drama. Wolfgang Windgassen (Tristan); Martti Talvela (King Mark); Birgit Nillson Isolda; Eberhard Waechter (Kurvenal); Claude Heater (Melot); Christa Ludwig (Brangane); Erwin Wohlfahrt (Shepherd) and others with the Chorus and Orchestra of the Bayreuther Festspiele conducted by Karl Bohm. DGG Stereo 2720 057.

This was the third of the three great Tristan recordings issued during the middle 1960s. The conductors of the other two were Furtwangler (HMV) and Solti (DECCA). The singers and orchestras varied, though it would be profitless in the space available to compare the productions singer by singer and note by note except in rare, significant instances.

But let me say at the outset that I have had—and loved despite their differences—the other two for many years, and that I acquired the Bohm only last month when I listened to it for the first time. I confess right away that I fell for it hook, line and sinker—as the saying goes.

True there are slight details in the performances of the other two that I prefer, but judging Bohm's production as a whole I consider it the best. It was recorded live at the 1966 Bayreuth Festival where the inspired placing of the microphones recapture, in all but a few bars, the glorious acoustics of the Bayreuth Festspielhaus to give us a peerless balance between voices and orchestra. It may be recalled that in the Furtwangler, in which the superb Flagstand was the Isolda, it was necessary for Schwartzkopf to stand by to take high notes that were then outside the aging Flagstad's range.

In Bohm's recording the Isolda is Birgit Nillson who fills the role in a performance that will live long in glory. I have heard her in the part many, many times, both live and on disc, but in this performance she surpasses anything she has ever done before. Apart from the splendour of her voice she is the living embodiment of the character, mature yet reckless in her anger, meltingly beautiful in her love scenes, yet at all times refined in her sensuality. The same might be said of Bohm's control over the whole production.

Despite the live recording there is a micro-minimum of extraneous stage sounds and the audience behaves with unsurpassable decorum. I couldn't even hear the softest cough. Except for the perfection of the sound, which wears amazingly well, the performance might have been recorded in an empty hall.

I could go on for pages describing Bohm's total commitment to the wonderful score, not the least feature of which is his respect for the short silences. If Nillson starts a trifle unsteadily it takes her practically no time at all to recover and give a performance which I consider quite peerless by present day standards. The same might be said of Christa Ludwig's Brangane, though here you have to wait till the second act to hear her at her best. This is not to say that she hasn't some transcendentally lovely moments in the first act, too.

Wolfgang Windgassen is a noble Tristan, his full, rich tenor entirely free from any hint of a Bayreuth "bark." His demeanour, even when discovered in guilt, remains courtly, his passion in the tumultuous love scenes ardent without any forcing of his voice.

Eberhart Waechter's Kurvenall is not the boisterous soldier depicted in so many other readings of this important part. Waechter's is dominated by his love and respect for his master for whom he willingly lays down his life and takes purely human revenge on Melot, his master's betrayer. You feel that he thinks that Tristan at his most guilty in his betrayal of King Mark can do no wrong and that there only remains Kurvenal's loving protection to prevent his being found out.

Then among the chief characters is Martti Talvela's knightly King Mark, his bass so enchanting to hear that all sense of boredom with his moralising in Act 2 is completely forgotten. Special mention must be made of Erwin Wohlfahrt's Shepherd. And in his contribution I might mention that in Act 3 Bohm uses the Bayreuth alpenhorn, instead of the previously used cor anglais, to express by the clarion jubilation of its tone Isolda's return to her dying Tristan.

While it is true, from a realistic point of view, that it would have been extremely unlikely that the Shepherd would have had two different instruments to express the difference between despair at the sight of an empty sea and joy at the appearance of Isolda's ship, one is never concerned with realism in Wagner's wholly engrossing score. I personally consider it to be one of the greatest achievements of the human mind.

Bohm's reading is at once miraculously sympathetic to the singers but utterly authoritative in his command of his splendid cast. To me the Bayreuth Orchestra has never sounded better, though I must mention that the only disappointment I felt was in the recording (a little too faint) of the hunting horns, played out of sight at the opening of Act 2. There are also one or two moments when the voices have a slight tendency to dominate the ensemble in a way not uncharacteristic of DGG's operatic recordings. But these are details I feel churlish about pointing out , so great was my enjoyment of the whole production. Parts of the final liebestod provide readily available instances to check on this favouring of the voice.

One other point of interest. In the Solti version one side is given to the conductor rehearsing the performers. The same occurs in the Bohm recording but here the conductor's German remarks are translated — or rather summarised into English so that anyone can follow Bohm's remarks with the greatest ease. All three sets I have mentioned in this review are superb, but to me the Bohm is the finest of all.

* * *

WAGNER — Tristan and Isolda excerpts by the same cast as above. DGG Dolbyed Stereo Cassette 3306 001.

This cassette is a neatly cobbled collection of excerpts from the complete set reviewed above. During its 51 minutes of playing time it gets in the Prelude to Act 1 and part of the second act love duet starting with the relaxed sequence and finishing at a spot that doesn't spill too much blood during the surgery. These are on the first side.

Side Two continues the Love Duet and runs it complete till the entrance of King Mark and the restatement of the Hunting Horn theme. Then comes the Prelude to Act 3, and then the Shepherd's long cor anglais solo, followed by Tristan's last outburst when Isolda's ship is sighted. The cassette finishes with the Liebestod which ends the opera.

The Dolbyed sound is excellent, so good that only the keenest ear might tell the difference between it and a disc if the equipment were out of sight — even then, most would not be prepared to bet on it. The whole cassette might be regarded as an aperitif that would send the average Tristan lover rushing to the nearest music store to get a complete set. I have only one tiny quibble — the brief annotations are in untranslated German which might cause some inconvenience to those unfamiliar with both the language and the whole work.

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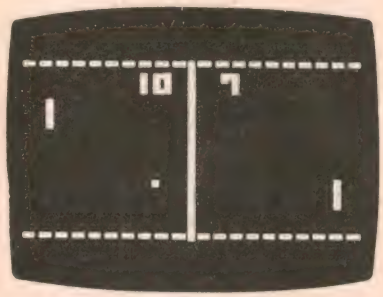

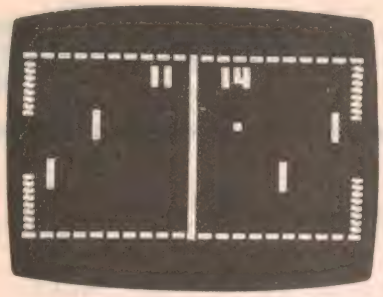

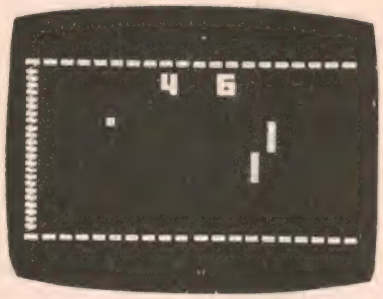

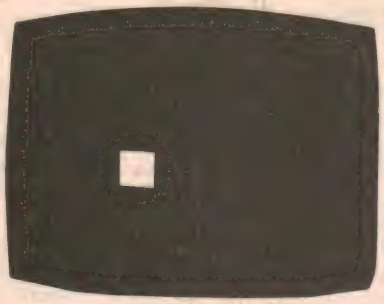

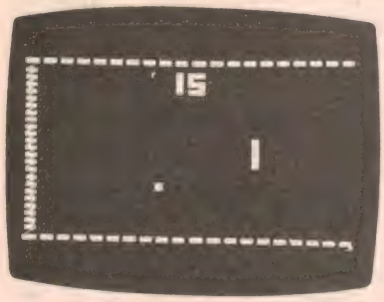

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SAINT-SAENS – Symphony No. 3 in C Minor (Organ Symphony) with Gaston Litaize at the organ and the Chicago Symphony Orchestra conducted by Daniel Barenboim. DGG Stereo Dolbyed Cassette 3300 619.

The folder on this cassette contains a bit more information that is usual for similar productions. Most of this is historical rather than analytical, but does include the fact that the organ part, played by Gaston Litaize on the Chartres Cathedral updated instrument, was superimposed on the orchestral recording. This has been done so skilfully that without pre-knowledge few would guess the tape had been manipulated. Indeed it makes for better balance between organ and orchestra than might otherwise have been achieved, however much purists might decry such "faking."

The sound is superbly spacious with a copious amount of detail and a wide range of dynamics used by Barenboim to produce highly sensitive inflections. His tempos are to me just right, without any of the freakishness in which he sometimes indulges elsewhere. His reading lends the work more stature then it usually receives. Moreover the Chicago's a grand orchestra nowadays and this performance—and recording—might well provide a thrill even for those who follow the fashionable trend to disparage everything Saint-Saens ever wrote. True some of his large output might well be disregarded, but by no means all. The very enthusiastic support he received from his contemporary Gounod might explain today's prejudices among the illuminati.

There is commendable restraint in the spirited first movement, a virile Scherzo beautifully pointed by the orchestra, and a Finale full of splendidly controlled differing moods. The range of frequencies is more than satisfactory. In the last bar of the Finale the organ continues to linger in the air for a moment after the orchestra stops but whether this is intentional or not I do not know. In any case I found the whole production most enjoyable.

* * *

STRAVINSKY – Le Sacre du Printemps. Complete ballet. The London Symphony Orchestra conducted by Colin Davis. Philips Dolbyed Stereo Cassette 7317 119.

This is another 10-year-old original sucessfully transferred to a Dolbyed cassette. Yet the sound remains good and the amount of detail that emerges from the complex score most commendable.

Although there have since been better recordings, at any rate on disc, than this reissue there are two features of Davis' interpretation that can immediately be appreciated. The first is Davis' obvious pagan delight in the work's stamping primitive rhythms; the other his lyrical treatment of much quieter reaches of the score, for example the openings to Scenes 1 and 2, though they do lack a sense of mystery. And if he spares us some of the more brutal aspects of the work his contrasting lyricism is quite without sentimentality. To put it another way, the women are unmistakably women, albeit primitive ones, and the men their warriors and masters.

From this you might well gather that Davis' is a pretty straightforward reading eminently suitable for an accompaniment to a stage spectacle, especially as choreographed by the fabled Nijinsky. And it must be remembered that the work was designed by Stravinsky for the theatre, though nowadays it is more often heard at a symphony concert than combined with dancing.

Like most of the great Stravinsky ballets it loses nothing as a piece of music – and a very influential piece at that. Listening to it I had the feeling that Davis was basing his reading on those recorded by Stravinsky himself, except that Davis' is better. The composer was never one to indulge himself or his audiences in extravagant espressimos.

Davis is slightly more relenting though never exaggeratedly so. He remains consistently exuberant. Le Sacre obviously excites Davis very much, and this he communicates to the listener without chasing too much subtlety. I think that if an entrepreneur had the idea of reviving the work in its original ballet form, Davis is the conductor he should choose. His reading is fresh and youthful and, even though he is now a little more than ten years older than he was when he made the original recording, I imagine it would remain so. As to acquiring it, my advice is to wait until some more alternatives appear on the market, though this is not to say that you might not even then prefer the Davis interpretation.

* * *

RIMSKY-KORSAKOV – May Night. Complete Opera. Alexei Krivchenja (Mayor); Konstantin Lisovsky (Levko); Ljudmilla Sapegena (Hanna); Anna Matjushina (Sister-in-law); with the Chorus and Orchestra of the Moscow Radio conducted by Valdimir Fedoseyev. DGG Stereo SLP 2709 063.

So far as I can trace, this is the first complete recording of Rimsky's early but tuneful opera. Although the material sounds a trifle thin when compared to such more mature compositions as Le Coq d'Or, and lacks some of the latter's exquisite glitter, it nevertheless displays all the early brilliance of Rimsky's scoring. Like most Russian operas it contains many genuine folk songs and other melodies that sound very much like them.

One has come to always expect superb chorus work in Russian Operas and you have it here, too. The orchestra is also in top form and immediately responsive to the conductor.

Levko, tenor Konstantin Lisovsky, is a reliable performer, a little throaty at times but always secure in pitch throughout his range. Balance between the singers and orchestra is never a problem. And Lisovsky, despite his very forward characteristically Russian production, can still make his voice very expressive in lyrical passages. All the other men are good.

But as in most Eastern European productions the women are awfully shrill in voice, in quality and with a wobble that Fred Astaire might easily fit a step dance to. Another oddity – the libretto is by Rimsky himself and contains, at any rate in translation, such poetic gems as "The water is lapping in the lake as quietly as a child in its cradle." And although the diction is clear it is difficult to follow the translation.

Because May Night is a comparatively early work, it is not surprising to find influences of the styles of previous operatic composers. There is, for instance, more than a hint at times of Weber's Oberon and some tunes of Rimsky's own that he himself used in later works. Indeed some of them will tantalise you to identify. But in its favour, the work, though early, has a very professional polish, the sound is fine, and the chorus sings as well as one has come to expect from that part of the world. The action is a fairy story that tells of a spring night in the Ukraine – during the last century, of course.

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y^x, e^x, 10^x, $\sqrt{x}$, $1/x$, $x!$, $x \leftrightarrow y$, π, CHS	Yes	Yes
$\sqrt[x]{y}$ through INVERSE	Yes	No
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Polar to Rectangular Conversion	Yes	Yes
Recall Last X	Yes	Yes
Scientific Notation, Fixed and Floating	Yes	Yes
Fixed Decimal Point Option (0-9)	Yes	Yes
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DISPLAY OF DIGITS	12	10
%, Δ%	Yes	Yes
GROSS PROFIT MARGIN %	Yes	No
Mean and Standard Deviation	Yes	Yes
Σ+, Σ−	Yes	Yes
Product – Memories	Yes	Yes
C-F. DIRECT CONVERSION	Yes	No
F-C. DIRECT CONVERSION	Yes	No
LIT-GAL. DIRECT CONVERSION	Yes	No
KG-LB. DIRECT CONVERSION	Yes	No
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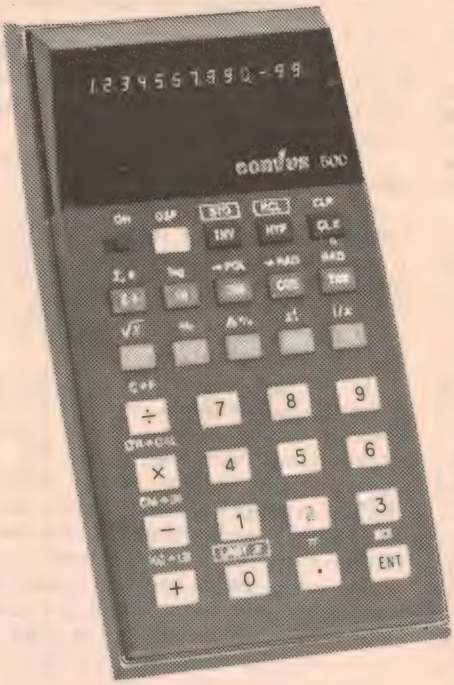

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Perhaps at this point we should address ourselves to the controversy between algebraic entry and RPN. One question we must ask is why proponents of algebraic entry always use an example of sum of products and never an example of product of sums:

$(2+3) \times (4+5) =$

Algebraic 2 + 3 = MS 5 + 4 = X MR = TOTAL 12 keystrokes (SR51, add 2 more keystrokes)

RPN: 2 Enter 3 + 4 Enter 5 + x
TOTAL 9 keystrokes

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Lighter Side

Reviews of other recordings

Devotional Records

HIS HAND IN MINE. Elvis Presley with the Jordonaires. Stereo, RCA ANL1–1319.

Unless my memory is playing tricks, I reviewed this album many years ago, the jacket adorned with a picture of Elvis, complete with angelic expression and lace cuffs! A placid and still youthful picture gazes out from this re-release but the cuffs are gone.

The program is a mix of gently swinging Gospel songs intermixed with a sprinkling of up-tempo numbers, with Elvis swapping the lead periodically with that excellent backing group, the Jordonaires. The titles:

His Hand In Mine – I'm Gonna Walk Dem Golden Stairs – In My Father's House – Milky White Way – Known Only To Him – I Believe In The Man In The Sky – Joshua Fit The Battle – He Knows Just What I Need – Swing Down Sweet Chariot – Mansion Over The Hilltop – If We Never Meet Again – Working On The Building.

I imagine that many of Elvis' fans from way back will have this one in their collection already but, if not, here it is again. For those who don't know quite what to expect, it's typical Gospel platform entertainment, even conservative by today's standards, but smooth and well produced. I noted a trace of intermodulation here and there but, overall, the quality is okay. (W.N.W.)

★ ★ ★

FAMILY VOLUME 5. Stereo, M7, MLF-136. Cassette FM7C7-136.

If any verification is necessary of the popularity of the Australian group "Family", it should follow from the fact that this is their fifth album. The jacket picture shows three cheerful young men in the old tram in Sydney's "Old Spaghetti Factory" restaurant, but who they are, what instruments they play, and who else is involved, is left to the listener's imagination. But it's an excellent program of rock Gospel sound, tailor made for church youth group listening. The titles are new to me but here they are:

Welcome/My Kind Of People – He Ain't Heavy, He's My Brother – Remember Whose Child You Are – Front Seat, Back Seat – Thank You Lord, This House Runs On Sunshine – Little Country Church – Oh Boy! Have I Been Stupid! – I Wouldn't Be Much Of A Friend – Song For Susan Louise – I Love You.

Diction is not one of the Family's strong points but their harmony is first rate, as also is the instrumental backing. And there's a lot of imagination, too, behind the planning and arrangement of the numbers and variations, even to the simulation of old-time sound quality for "Oh Boy! Have I Been Stupid". Elsewhere, it's normal.

Not everyone's choice of Gospel music but it should go over well with those who like the mod. sound. (W.N.W.)

RICHARD & PATTI, vocal, with orchestra and chorus. Stereo, Light LS-5673-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capital.)

I would gather that Richard and Patti are well known on the American Gospel scene, such that surnames are redundant. I'm afraid that, at this remote distance, "Richard" and "Patti" must suffice.

The first number is an up-tempo item: "Get All Excited" but the remaining tracks on side 1 are much more restrained, done with piano, chorus and gently swinging orchestral backing: Take A Little Time – For Those Tears I Died – King Of Kings – Lord Of Lords.

Side 2 is rather similar, opening with a lively "Greater Is He" followed by quieter selections: He Giveth More Grace – Holy, Holy, Holy/Holy, Holy – The Lord's Prayer. The final track "The Church Triumphant" is half-way between a song and a sermon!

With orchestral accompaniments arranged and conducted by Larry Dalton, featuring Larry Dalton on piano, and with vocal backing by the World Action Singers, it's a very professional performance, well recorded. Good middle-of-the-road family Gospel sound, although that final track may come on a bit strong for Australian ears! (W.N.W.)

Instrumental, Vocal and Humour

SUPERSTAR BRASS. The Band of Yorkshire Imperial Metals Top Brass Series GGS 1508. Astor release.

Records of brass music such as this must surely dispel any image of the old style 'band-in-the-park' image with nine titles ranging from Rossini to Rock as they say on the sleeve notes.

The titles are Florentiner March – El Cumbanchero – Holiday for Trombones – Summertime – The Silken Ladder – Procession Of The Sardar – The Typewriter – Largo Al Factotum – Godspell – Jesus Christ Superstar Medley.

The quality is excellent, recorded in a large studio if one can take notice of the echo on some tracks. Sleeve notes list nearly thirty musicians and the conductor is the well known Trevor Walmsley D.F.C. It is good to hear a group of musicians like this who obviously enjoy what they are doing. (N.J.M.)

★ ★ ★

101 STRINGS, 20's STYLE Astor Gold Star Series S-5331 (Musicassette BCT5354).

The 101 Strings Orchestra does a delightful job in re-creating the sound and style of popular dance music of fifty years ago, with favourites like: Stardust – Limehouse Blues – Tea For Two – Someone To Watch Over Me – Who'll Buy My Violets – Speakeasy Blues – 3 0'clock In The Morning – Manhattan – Rhapsody In Blue – Violence.

The style is mainly gentle, ideal for a background sound for a pleasant social evening with friends. The exception is the last track. "Violence", which opens with a burst of sub-machine gun fire, in stereo no less. There seems to be a boom in music from the earlier decades of this century and music such as on this record can surely show the reason why.

The quality was a little edgy on the review copy. (N.J.M.)

★ ★ ★

THE BAND OF THE LIFE GUARDS. Soldiers Of The Queen. This Record Co Ltd L25266. Festival Release.

Some of the best known brass band favourites, some of them well known as TV themes, make up the dozen tracks on this disc. The quality is about the best I can recall for some time. Many of the brass band recordings I have heard suffer in some way, either lacking in highs or from excessive harshness. The band is directed by Major Anthony J. Richards, who, judging by the string of letters after his name, must be well well up in the band business.

The titles are: Soldiers Of The Queen – Rise And Shine – Soldiers In The Park

Reviews in this section are by Neville Williams (W.N.W.), J. Rowe (J.R.), Leo Simpson (L.D.S.) Norman Marks (N.J.M.) David Edwards (D.W.E.). and Greg Swain (G.S.)

– The Whitehall Warrior – Sovereign's Escort – Theme from 'The Regiment' – The British Grenadiers – Royal Standard – Lilliburlero – Sarie Marais – Colchester Castle – There's Something About A Soldier – The Boys Of The Old Brigade. The sleeve notes give a brief background to the tunes. (N.J.M.)

★ ★ ★

THE ROARING 20's 16 GREATEST HITS Enoch Light & The Charleston City All-Stars ABCS–746 RCA Release.

I don't claim to remember the roaring twenties but I can certainly remember these tunes being popular in my childhood. And Enoch Light and his crew have done a splendid job of creating the carefree sounds of dance music of the era.

As usual with most of Enoch Light's efforts, the technical aspects of the recording are beyond any reasonable reproach.

The titles are: Last Night On The Back Porch – I Wonder What's Become Of Sally – Rain – That's My Weakness Now – Sonny Boy – Rose Of Washington Square – California Here I Come – Somebody Loves Me – The Sheik Of Araby – Singing In The Rain – Sleepy Time Gal – Margie – Ma He's Making Eyes At Me – Baby Face – April Showers – I'm Sitting On Top Of The World. (N.J.M.)

GOLDEN HOUR PRESENTS WARM STRINGS GH 612 Astor Release.

If you are seeking a pleasant record as a background for a quiet social evening at home this would be a good choice, with twenty favourites played by an orchestra with plenty of lush strings to set the mood. A few of the tracks to illustrate: Memories Of You – Slow Boat To China – Beautiful Dreamer – Singing In The Rain – On Dream Street – Night And Day – All The Things You Are – Yesterday – Smoke Gets In Your Eyes – Three Coins In The Fountain.

The quality varies somewhat, no doubt due to putting thirty minutes playing time on each side but, in the context of background music, this can be forgiven. (N.J.M.)

★ ★ ★

HARMONICA MAGIC. Lubomir Oleva with the Ostrava Radio Orchestra, conducted by Pavel Stanek. Stereo, Astor GGS-1494.

To the short list of harmonica virtuosos, headed by Larry Adler, it would certainly be appropriate to add the name of Czech born Lubomir Oleva. Although the jacket notes stress that he is a physical education instructor by profession, with music only as a hobby, you would never guess as much from listening to this recording. His technique is as sensitive as it is flawless, as befitting one whose early training was on violin.

Side 1 carries a half dozen tracks, all modern transcriptions of light classics; Ciocirlia – Danza Espanola – Clair De Lune – Hora Staccato – Air On A G String – Sabre Dance. These give way to a new and different arrangement of modern standards on side 2: La Mer – Mexican Dance – Lonely Night Rider – Stardust – Isn't It Romantic? – Le Grisbi – Make Love To Me.

If you have an interest in the harmonica, you'll throroughly enjoy this one. Even if you don't, you could still find it pleasant, because the harmonica is merged so skilfully with the Ostrava Orchestra. Apart a slight touch of "stringiness" in the strings, here and there, the overall quality and stereo spread is good. (W.N.W.)

★ ★ ★

WOODY HERMAN. Vol 2 With Charlie Byrd and Tito Puente. Astor Gold Star GGS 1503.

Originally recorded in 1958, this album has been remastered from 78's. Considering this, the quality is fairly good.

Side one carries the lengthy 'Summer Sequence' followed by Latin Flight–New Cha Cha and Mambo Herd. Side two consists of Tito Meets Woody–Cha Cha Chick–Carioca–Blue Station–Pillar To Post.

The theme is mainly Latin as can be seen from the titles and I get the feeling that there has been no attempt to "rechannel for Stereo", as switching from mono to stereo showed no noticeable difference. I remember most of these tracks being released on a 'World Record Club' disc some years ago; it would present Woody at his peak. (N.J.M.)

★ ★ ★

FAREWELL MY LOVELY. United Artists L35734. Festival release.

This is another of those sound-track records that hold little interest unless you have seen and enjoyed the movie so much that you want to re-live it by way of the music.

The film stars Robert Mitchum and Charlotte Rampling amongst others, in what must be another 'Marlowe' detective story. The titles are: Marlowe's Theme – Velma – Mrs Grayles Theme – Amthor's Place – Mrs Florian Takes the Full Count – Marlowe's Trip – Convalescent Montage – Take Me To Your Lido – Three Mile Limited – Moose Finds His Velma – End Title.

The music tends to be a mixture of styles and the quality is good. (N.J.M.)

★ ★ ★

BING CROSBY. AT MY TIME OF LIFE. United Artists L 35889. Festival release.

With the release of this record, Bing Crosby celebrates fifty years of show business, and demonstrates that he has lost little of the vocal skill that has made him a household word throughout the world. The titles range from a gentle: "How Are Things In Glocca Morra?" to an uptempo "I Got Rhythm". Other

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Because the dynamic range of most recording equipment doesn't equal the dynamic range of live performances, the loudest sounds end up being very much compressed, while the softer sounds have to be lifted above tape noise.

So no matter how good your equipment is, it will never ever give a true performance.

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Fortunately for the home hi-fi buff there's now an extremely effective solution available.

The dbx 117.

Basically it's a dynamic range enhancer that works on the signal's voltage level without changing the frequency response. (Unlike other systems that are designed merely to filter out high frequencies.)

And attached to any good system it will noticeably increase the entire dynamic range of any signal put into it. While at the same time reducing surface noise.

So now your softs become even softer. While your louds, especially your crescendo's, become much more dramatic when they finally reach the top.

Consequently giving the recorded performance both more body and definition.

dbx will also improve the sound of your older records. So there's less need for you to have to replace them. (The dbx 117 will also help reduce hiss from FM broadcasts as well as your tapes.)

In fact should you desire to test the dbx before purchase, we then suggest you contact one of our dealers listed opposite and politely ask him to play you a copy of the 1812 Overture.

Should you still have a few reservations then all we have to say is that perhaps the 1812 Overture was recorded featuring a popgun.

Or your ears aren't as good as you thought they were.

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LIGHTER SIDE

tracks are: At My Time Of Life – Cabaret – Something To Remember You By – Heat Wave – My Heart Stood Still – Razzle Dazzle – Hello Dolly – Looking At You – I'll Never Fall In Love Again – Thou Swell – With A Song In My Heart – Great Day.

With the exception of the title track which was recorded in Los Angeles, the album was made in England with the backing of the Pete Moore Orchestra.

The original lyrics range from 1927 to 1976 so the time span is certainly indicative of Crosby's influence on the music scene. (N.J.M.)

★ ★ ★

MUSIC FROM THE GREEK ISLANDS Volume 2. The Trio Orfeo. RCA Camden stereo VCL1–0036.

Here is a talented trio who produce music that is often almost Latin-American in flavour, while still maintaining its Greek overtones. Even those who do not enjoy most Greek music should sample this disc. Recording quality is very good. Recommended.

Track titles are: Imittos – Boy On A Dolphin – Moustafa – O Sklavos Sou Ime (I Am Your Slave) – Siko Horepse Syrtaki (Get Up And Dance The Syrtaki) – Bepe's Solo – Anihe Apopse Ourania (The Skies Open Up) – The Pearl Fisherman – Ego Ke To Gaidouraki Mou (Me And My Donkey) – Stin Kaliva Ti Diki Mou (In My Small Hut) – Isos Na Methimate (She May Remember Me) – Sou Topa Mia Ke Dio, Ke Tris (I Told You Once, Twice, Thrice). (L.D.S.)

★ ★ ★

LOOK MY WAY. Rosemary Clooney. United Artists L35924. Festival Release.

It is a long time since I've heard a song from Rosemary Clooney and this album only points up what we've been missing. Back in the fifties, you could always hear one of her latest hits, like 'Botch-A Me' and Come On-A My House' on steam radio and this collection of mainly new hits is very welcome. Some of the titles are: Half As Much – When Will I Be Loved – Storms Never Last – Look My Way – I'm Not Lisa – Singing The Blues – When You Got Love – The Very Thought Of Losing You.

The recording was made in RCA's Nashville Studios, a virtual guarantee of high recording quality and the sleeve notes list all the supporting artists, including the Jordanaires. (N.J.M.)

★ ★ ★

THE ARTISTRY OF NELSON EDDY. Everest, Astor Release CGS 1499.

Anyone with a touch of grey around the temples will remember the MGM musicals starring Jeannette McDonald and Nelson Eddy. This record will bring back the sound of one of those voices in vocal settings of favourite classical excerpts.

Most of the tunes will be remembered as hits of the early post-war period, titles like: Tonight We Love, based on Tchaikovsky's piano concerto in B flat minor and 'Story Of A Starry Night' from the same composer's Sixth Symphony. Others are: The Lamp Is Low – My Reverie – Till The End Of Time – Strange Music – Full Moon And Empty Arms – Love Serendade – Stranger In Paradise – As The Years Go By – If You Are But A Dream.

The orchestral backing by Skitch Henderson suits the romantic mood set by the songs to make up a most enjoyable record with excellent quality. (N.J.M.)

★ ★ ★

THE KINKS' GREATEST: CELLULOID HEROES. The Kinks. RCA Victor APL1-1743.

While Ray and the other Kinks have not renewed their contract with RCA Victor, it appears that their existing tracks are still going to be pushed. This record is mainly filled with material from the 1972 era. In fact, quite a lot of the tracks appear to have been lifted from the "Everybody's In Show-biz, Everybody's A Star" album of that year.

Tracks featured are: Everybody's A Star (Starmaker) – Sitting In My Hotel – Here Comes Yet Another Day (live) – Holiday (live) – Muswell Hillbilly – Celluloid Heroes – 20th Century Man – Sitting In The Midday Sun – One Of The Survivors – Alcohol (live) – Skin And Bone (live) – A Face In The Crowd.

If you are a devout Kinks fan like me, then you will appreciate this album, as some of the tracks are different from the more widely known versions. And Reg Livermore fans will recognise the last track on the first side (Celluloid Heroes), which is possibly the best Kinks' track of all time.

As is usual with releases on this label, the quality of the recording is excellent, with very little surface noise, and only slight traces of distortion. (D.W.E.)

★ ★ ★

TURNSTILES. Billy Joel. Stereo. CBS Records SBP 234797.

After his success with "Piano Man", I was expecting a lot from this album and, happily, I was not disappointed. From the opening track to the closing one, this record is one long enjoyable experience. Aided by capable session men, and with his own excellent keyboard work to back him up, Billy gets into his stride in the first track, and never looks back from there.

All the lyrics are provided on the inner sleeve of the album cover, so it is possible to gain an insight into the songs without having to strain the ears. But, in any case, Billy has excellent diction.

I won't attempt to analyse the album, but I will give you my thoughts on the last track. This is entitled "Miami 2017 (Seen The Lights Go Out On Broad-

LIGHTER SIDE

way)", and it is really superb. It is a science fiction fantasy, and it evoked quite fantastic imagery in my mind. If you sample any tracks at all, sample this one.

Overall, I can definitely recommend this album, both technically and aurally! (D.W.E.)

★ ★ ★

ELECTRIC WARRIOR. T. REX. Cube Records Hifly 6. RCA release.

Marc Bolan and T. Rex have been around the scene for quite a while now, and they have been quite successful to date. This record appears to be a reissue of an earlier (about 1971) album, and as such is only of interest to collectors and those who missed out the first time around.

Tracks featured are: Mambo Sun – Cosmic Dancer – Jeepster – Monolith – Lean Woman Blues – Get It On – Planet Queen – Girl – The Motivator – Life's A Gas – Rip-Off. Recording quality is adequate only; there are traces of both background noise and distortion. (D.W.E.)

★ ★ ★

SECOND CHILDHOOD. Phoebe Snow. Stereo. CBS SBP 234799.

This is Phoebe Snow's second album, and although I have not heard her first one, judging by this effort it must have been fairly good. Phoebe has a pleasant, melodious voice, which she uses to full advantage. Her exact style is difficult to categorise, but has some resemblance to that of Rita Coolidge.

Tracks featured are: Two Fisted Love – Cash In –Inspired Insanity – No Regrets – Sweet Disposition – All Over – Isn't It A Shame – Goin' Down For The Third Time – Pre-Dawn Imagination – There's A Boat That's Leavin' Soon For New York. Technically, the record is good, with a very clean sound. (D.W.E.)

★ ★ ★

CONEY ISLAND BABY. Lou Reed. RCA Victor APL1-0915.

Lou has gone back to basics for this album. It is a mixture of hard and soft rock, with his unique "talk/sing" vocal style still dominant. The songs on this album seem to veer away from his more usual depressing subjects, and at times become even slightly humorous.

The eight tracks are as follows: Crazy Feeling – Charley's Girl – She's My Best Friend – Kicks – A Gift – ooohhh Baby – Nobody's Business – Coney Island Baby. The tracks I was impressed with were "She's My Best Friend" and "Coney Island Baby". The first track on the second side is sure to meet with a mixed reception from the fairer sex.

Record quality is average, with some background noise, although this is not obtrusive. (D.W.E.)

Popular cassettes:

MOTORING MUSIC 5. The Floyd Harris Orchestra. Dolby stereo cassette, Contata A-109. (From Goldring Sales & Service.)

I seem to have remarked before that the Contata cassettes impress most with programs that have been specifically chosen for drive-time listening. The sound is varied from track to track, in this case by the introduction of Abert Lizzio and the Solisten, and Otto Weiss with the Seinem Ensemble. So you get a mix of orchestral, organ, and chorus, with an evident continental flavour. The tracks:

Dance Of Time – Younger Day – Party Snake – Narcissus – Hello Smarty – Bianca – Pajaro Serrano – Viens, Viens – Danny Boy – Red Beans – Tie A Yellow Ribbon – Guaguqnco.

The overall quality is about average for pre-recorded cassettes but, as I said, the program content would be excellent for drive time listening or as background in the home. Remember that it's Dolbyised, so throw the Dolby switch or turn down the treble a notch. (W.N.W.)

LOVE IS A MANY SPLENDOURED THING. Ray Conniff, his Orchestra and Chorus. Stereo, cassette, Harmony (CBS) HC-1136.

Ray Conniff and his tuneful orchestra and chorus set an amorous mood with "Love Is A Many Splendoured Thing", followed immediately by "Lover, Come Back To Me". But, if the listener was in any danger of embarking on a sentimental journey, an up-tempo "Blue Moon" could pull them up short. It's followed by "Love Has No Rules" and "Just Kiddin' Around".

Side 2 offers: "Moscow Nights", "Early Evening", "Yellow Rose" and "Just One Of Those Things"—the whole adding up to something over 20 minutes of average middle-of-the-road program. Quality is also average, not really hifi fare but quite okay for casual or drive-time listening. (W.N.W.)

I'M NOT IN LOVE. Tony Christie. Stereo Musicassette, MCA (Astor ACT 2664).

A typical popular vocalist, Tony Christie is at great pains to make the point as per the title track, with twelve numbers: Queen Of The Mardi Gras – Like Sister And Brother – Love Hurts – I'm Not In Love – Feelings – Part Time I Love – Nobody Cried – No Other Love – Wall Of Silence – The Way We Were – Drive Safely Darlin' – Somewhere In The Night.

With accompaniments ranging from pensive piano and sentimental strings to rhythm and rock, it's a wide ranging program that should please those that like the Tony Christie style. The sound quality is okay. (W.N.W.)

THE BEST FROM BERT KAMPFERT. Played by the Sid Sidney Orchestra Stereo Dolby cassette, Contata A-118. (From Goldring Sales & Service.)

Despite the promise of the title, the TDK tape and the Dolby processing, I found this cassette to be anything but "the best". The Sid Sidney Orchestra is okay but quality is suspect from the very beginning where the lower level orchestral ambient seems to be surging, maybe suggesting that the Dolby circuitry was acting up. And, elsewhere, string tone is often noticeably coarse.

A pity, because there are plenty of popular numbers: Strangers In The Night – 3 O'clock In The Morning – African Beat – That Happy Feeling – Michaela – The World We Know – Meeting Again – Spanish Eyes – Swinging Safari – Thank You – Hold Me – Red Roses For A Blue Lady – Wonderful By Night – Down By The Riverside.

You want it mainly for drive time listening? Yes, it would be okay for that but not for the hifi situation. (W.N.W.)

An Introduction to Digital Electronics—11

Encoding & Decoding

Information is usually handled within digital systems in coded form, as this tends to be more economical of circuitry. At the interface between humans and systems, it therefore becomes necessary to perform encoding and decoding. This chapter looks at the basic ways in which these operations are performed.

by JAMIESON ROWE

As we have seen in earlier chapters, digital circuits and systems are often used to convey, process or acquire information. The information may consist of either numerical data or messages, or a mixture of both, but whatever its content it is normally capable of being expressed in human language using alphanumeric symbols.

While the information is normally in human language form when it ultimately emerges from a digital system, and also before it may be fed into a system, within such a system it generally exists as an electrical, magnetic or perhaps even an optical representation. And typically this representation consists of suitable combinations of two discrete values of voltage, current, or magnetic or optical flux.

Although the representation may be a direct one—for example, using 26 different digital signals to represent the 26 alphabetic characters, this is rather inefficient and is not usually done. Instead the information is usually handled in encoded form, as we have seen, using each of the various unique truth-value combinations of a group of binary digits or "bits" to represent one of the usual human language symbols.

Encoding gives a considerable increase in information-carrying efficiency, because the truth-value combinations provided by a group of bits rises exponentially with group size. If there are N bits in the group, the number of unique truth-value combinations available for encoding is equal to the Nth power of 2.

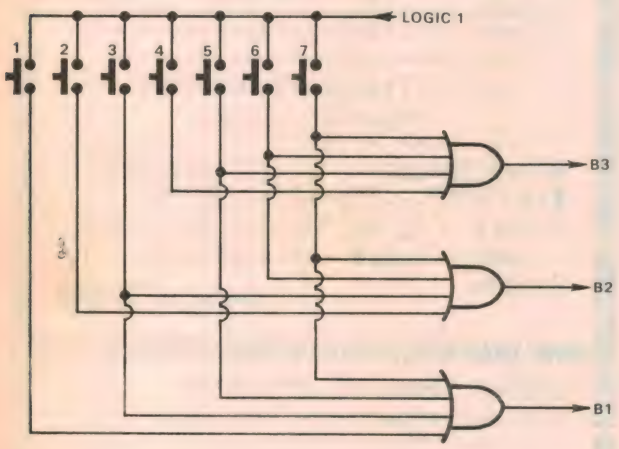
Four bits accordingly provide 16 truth-value combinations, enough to encode the 10 decimal digit symbols with 6 combinations to spare. And as we saw in chapter 7, seven bits provide no less than 128 truth-value combinations, sufficient to encode all of the alphanumeric and control characters of the ASCII code.

When information is to be fed into a digital circuit or system then, it is generally first processed by a type of circuit known as an **encoder.** Conversely when information is to emerge from a digital circuit or system, it is generally processed by a complementary type of circuit known as a **decoder.** In the remainder of this chapter we will look at the way in which these encoder and decoder circuits operate.

As the name itself implies, the function of an encoder circuit is to accept any one of a number of different input signals, and generate in response to each one a code "word" or group of bits having a pre-assigned unique combination of truth values. As we have seen, the number of bits in the generated code word will depend upon the number of different input signals the encoder is required to handle.

In its most basic form, an encoder consists of a set of multi-input OR gates, with one gate for each of the code bits.

A simple 3-bit encoder is shown in Fig. 1. Here there are seven inputs to the encoder, provided by a set of pushbutton switches, and the encoder is designed to provide output code words which are simply the binary equivalents of the digits 1-7. This is shown in the truth table.



INPUT	B1	B2	B3
(0)	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1

FIG. 1 : BASIC 3-BIT BINARY (OCTAL) ENCODER

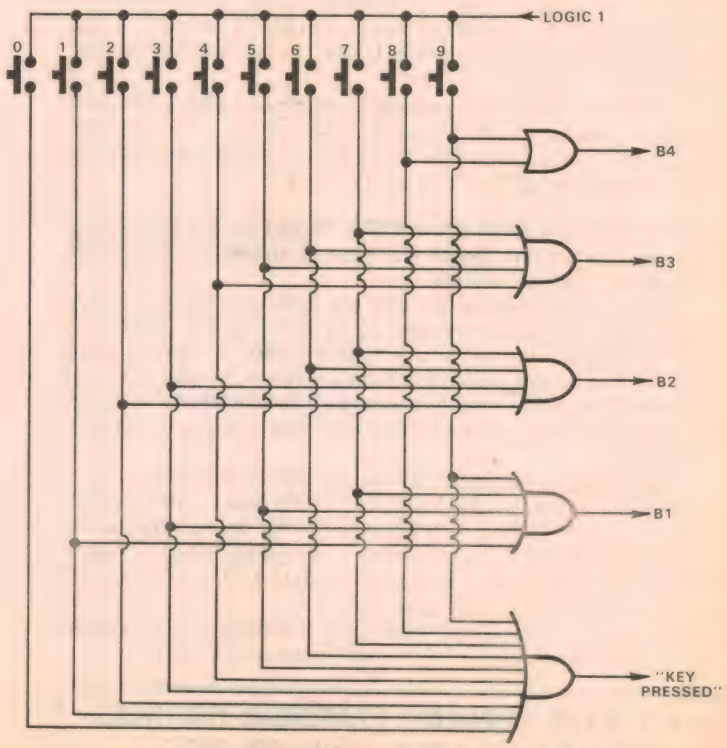


FIG. 2 : 4-BIT 8421 BCD ENCODER WITH "KEY PRESSED" OUTPUT

The actual encoding is done by connecting each input line to an input of those gates required to produce a logic 1 output for the appropriate output code. Thus the "1" input line connects only to an input of the B1 gate, while the "3" input connects to input of both the B2 and B1 gates. Similarly the "7" input connects to inputs of all three gates.

Note that when none of the input buttons is pressed, all three gates will be disabled, and the output lines will all be at the 0 logic level. This corresponds to the eighth possible truth-value combination provided by three bits, and is therefore shown in the truth table for completeness. However with this simple circuit it would not be possible to have a "0" input button, because it would not be connected to the gates and would therefore be ineffective.

If all of the possible truth-value combinations of an encoder are to be utilised for coding, it is necessary to modify the basic encoder circuit by adding a further multi-input OR gate, with one input connected to all input lines. This then produces a logic 1 output whenever any of the keys are pressed, allowing even the "all zeros" truth-value combination to be used for coding.

This is shown in Fig. 2, where as you can see the 10-input gate at the bottom of the diagram is used to generate the required "key pressed" signal. This can be used by subsequent circuitry to trigger processing of the generated code word.

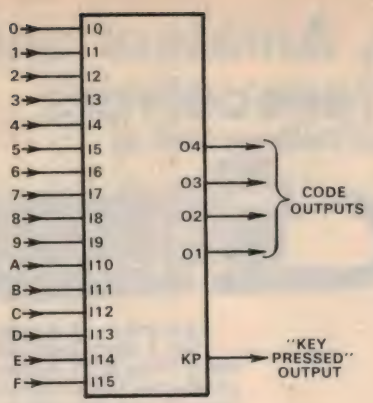


FIG. 3 : INTEGRATED 4-BIT BINARY (HEXADECIMAL) ENCODER

INPUT	OUTPUTS				
	O1	O2	O3	O4	KP
(NONE)	0	0	0	0	0
0	0	0	0	0	1
1	1	0	0	0	1
2	0	1	0	0	1
3	1	1	0	0	1
4	0	0	1	0	1
5	1	0	1	0	1
6	0	1	1	0	1
7	1	1	1	0	1
8	0	0	0	1	1
9	1	0	0	1	1
10(A)	0	1	0	1	1
11(B)	1	1	0	1	1
12(C)	0	0	1	1	1
13(D)	1	0	1	1	1
14(E)	0	1	1	1	1
15(F)	1	1	1	1	1

The decoder shown in Fig. 2 generates four code bits, and is arranged to perform encoding of 10 inputs into the 8421 BCD code. You may care to draw up a truth table based on the circuit connections, to verify that this is the case.

Although encoder circuits may be produced by connecting up discrete gates along the lines of Figs. 1 and 2, integrated circuit manufacturers have largely made this unnecessary by producing prepackaged encoder circuits. These may be treated as functional "black boxes", with a set of inputs and output whose relationships are given by a truth table.

This is illustrated in Fig. 3, which shows the logic diagram and truth table for an integrated 4-bit binary encoder which provides encoding for all 16 possible inputs, in addition to a "key pressed" or KP output. Such an encoder could be used to handle numerical information in either hexadecimal form, as shown, or in normal decimal form by simply ignoring inputs I10-I15.

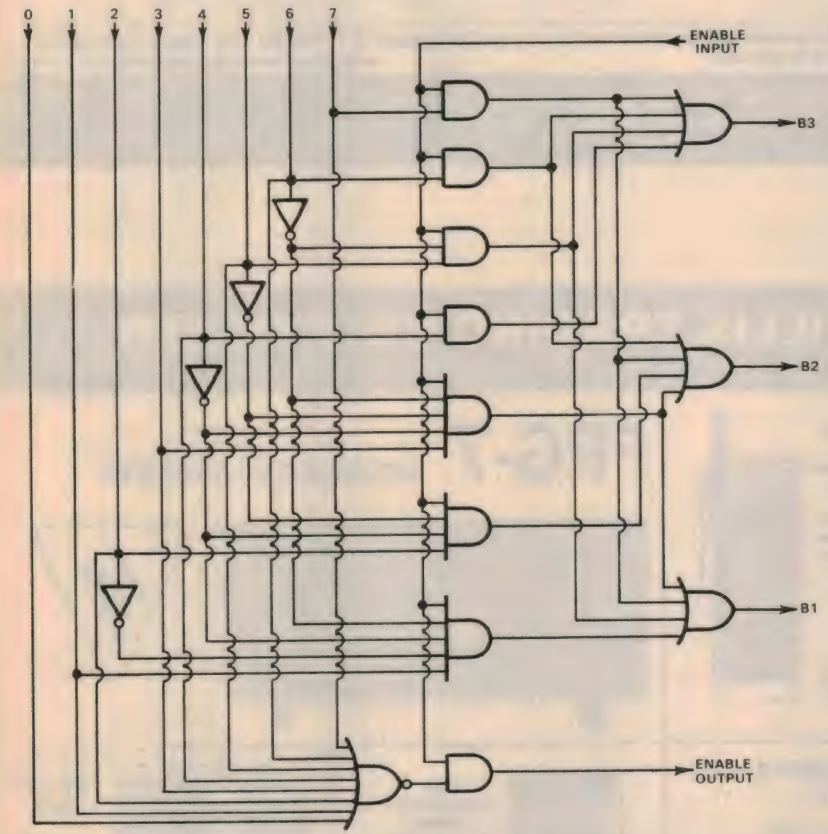
Simple encoders of this type are typically used to accept information from small input keyboards, and prepare equivalent code words for use in a computer, calculator or other digital system.

Where a large number of input keys are to be encoded, in theory it is possible to expand the basic OR-gate encoding scheme to provide the required number of code bits and input lines. However, in practice this can become rather clumsy, involving numerous connections and gates with large numbers of inputs.

As a result designers of large keyboard encoders tend to use one of a number of modified encoding schemes. Mostly such schemes involve connection of the keys into a two-dimensional array or "matrix", and augmenting the basic OR gate system with some sort of sequential scanning. This will be discussed in chapter 12.

For the present, there is one further type of simple encoder circuit which should be discussed. This is the so-called **priority encoder.**

A priority encoder is not generally used



INPUTS									OUTPUTS			
EN	0	1	2	3	4	5	6	7	B1	B2	B3	EN
0	X	X	X	X	X	X	X	X	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	1
1	1	0	0	0	0	0	0	0	0	0	0	0
1	X	1	0	0	0	0	0	0	1	0	0	0
1	X	X	1	0	0	0	0	0	0	1	0	0
1	X	X	X	1	0	0	0	0	1	1	0	0
1	X	X	X	X	1	0	0	0	0	0	1	0
1	X	X	X	X	X	1	0	0	1	0	1	0
1	X	X	X	X	X	X	1	0	0	1	1	0
1	X	X	X	X	X	X	X	1	1	1	1	0
X = "DON'T CARE" (EITHER 1 OR 0)												

FIG. 4 : 3-BIT PRIORITY ENCODER

for encoding information from a keyboard, but for responding to logic signals generated by preceding digital circuits. Like the simple encoder of Figs. 1, 2 and 3 it produces a unique output code word for each input, but there is an important difference. The various inputs are arranged in order of "priority", so that if two or more input signals are applied at the same time, the encoder generates the output code corresponding to the input with the highest priority, effectively ignoring the others.

Why do this? Well, there are quite important applications in digital circuitry where a system—such as a computer or controller—must respond to a number of signals, but some of the signals must be regarded as more "important" or more "urgent" than others.

An example of this is the "interrupt" facility on many computers. Here the control circuitry of the computer is provided with a means whereby it can be forced to "drop what it is doing", and handle an urgent data input or other transaction. There are often a number of interrupt sources, and it is generally necessary to give them an order of priority—so that the most important transaction cannot be interrupted by less important ones, and so on. A priority encoder is generally used at the interrupt inputs, to both provide an encoded identification for the interrupt signal source, and to ensure that the source with the highest priority takes precedence.

A three-bit priority encoder is shown in Fig. 4. As you can see, it has a set of AND gates ahead of the actual encoding OR gates, to establish the priority order of the signal inputs.

If you trace through the logic, you will find that input 7 takes priority over all of the other signal inputs. Then if input 7 is at logic 0, input 6 takes priority over the remaining inputs, and so on.

The encoder also has an enable input and output, to allow a number of similar circuits to be cascaded if a larger priority encoder is required. The encoder only works if the enable input is at logic 1, and only produces a logic 1 level at its own enable output if (a) the enable input is at logic 1, and (b) none of its own inputs are at logic 1.

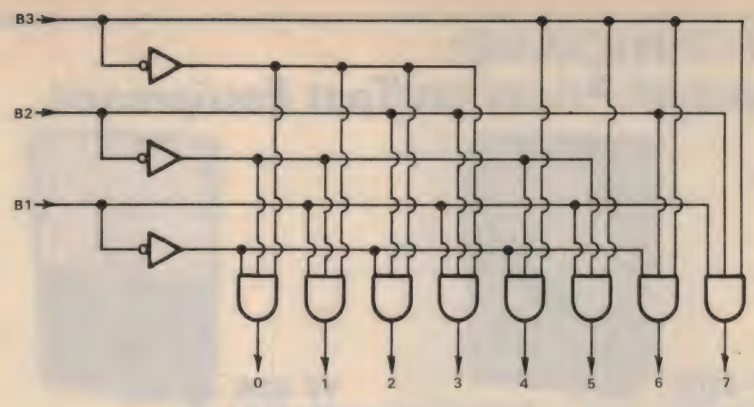


FIG. 5 : BASIC 3-BIT BINARY (OCTAL) DECODER

The enable input would normally be driven by the enable output of a "higher priority" encoder, while the enable output could be used to drive the enable input of a "lower priority" encoder. The enable input would otherwise be connected to logic 1, if the encoder were being used alone or was the one in a group with the highest priority. Similarly the enable output could be ignored if the encoder were used alone, or was the one in a group with the lowest priority. Alternatively it could be used as an active-low "signal present" output, equivalent to the "key pressed" output of Figs 2 and 3.

Having looked briefly at basic encoder circuits, let us now turn to the circuits which perform the complementary logic function: decoding.

Essentially, a decoder circuit is one which accepts information in encoded form, and regenerates signals corresponding to the original information before it was encoded.

Practical decoders do this by having an array of AND gates, each of which is arranged to respond to a particular unique combination of truth-values on the incoming code bit lines. Normally there is a gate provided to respond to every possible truth-value combination of the code bits, so that all combinations may be decoded.

A basic 3-bit binary encoder is shown in Fig. 5. As you can see, it has eight AND gates, each arranged to respond to one of the eight truth-value combinations possible with 3 bits. Apart from the AND gates there are three inverters, used to provide complementary versions of the incoming code signals to those gates which need them.

Thus to respond to the code combination 101, corresponding to octal 5, the appropriate AND gate must be fed with B1, B3 and the complement of B2. Similarly to respond to 011, corresponding to octal 6, the next AND gate must be fed with B2, B3 and the complement of B1.

Note that only one output of the decoder can be at logic 1 level at any one time, because each gate responds to a unique truth-value combination of the code bits, and there is a gate for all possible combinations.

The simple binary decoding system of Fig. 5 can easily be expanded, by adding further gates. Fig. 6 shows a 4-bit binary decoder, which as you can see is similar to the 3-bit decoder except that the decoding gates here have 4 inputs each, and four inverters are required. This decoder could be used for decoding hexadecimal information, or for decoding information in one of the BCD codes if outputs A-F were ignored.

It may seem wasteful to suggest that one would use a decoder like that of Fig. 6 to decode BCD information, by ignoring 6 of the outputs, but the fact is that nowadays this is very often the cheapest way of doing the job—thanks to modern IC technology. Full 4-bit binary encoders

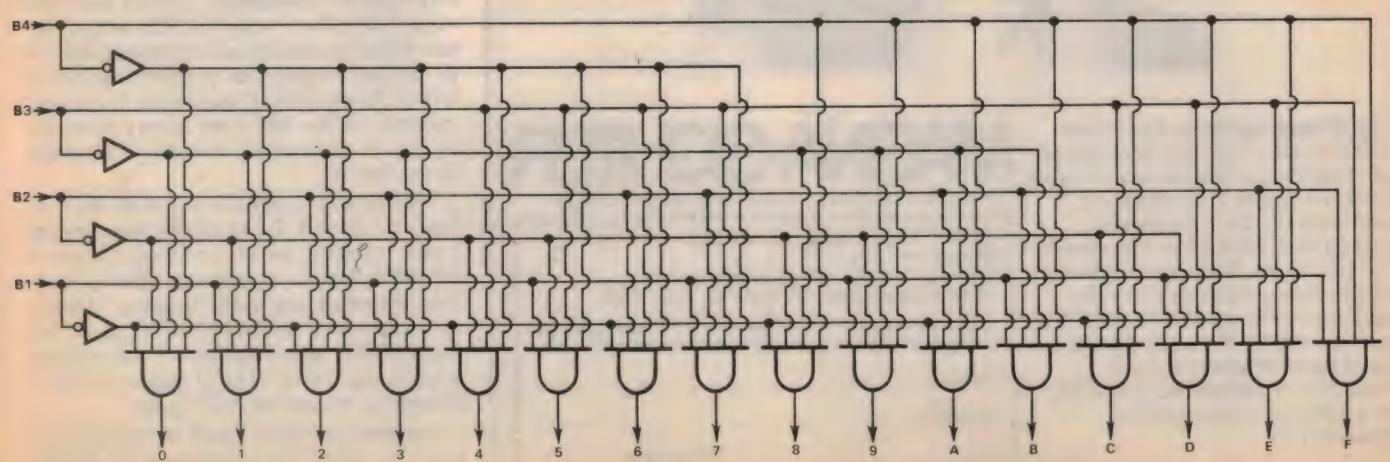


FIG. 6 : 4-BIT BINARY (HEXADECIMAL) DECODER

are available as single integrated circuits, at a price considerably lower than if a 10-output BCD decoder were built up from separate gates.

Of course before integrated decoders became available, designers had to produce their own decoders using separate gates, and there was a strong incentive to be as economical as possible. This being the case, they found all sorts of ways of reducing the number of gates required—particularly where only BCD decoding was required.

It was soon realised, for example, that if a decoder was only going to be used to decode BCD information it didn't really need to sense every code bit for the decoding of each and every truth-value combination. With some combinations, it became sufficient to sense only some of the bits, because these were adequate to distinguish that combination from the others.

This concept of "sufficient definition" was used to produce minimal logic BCD decoders, like that shown in Fig. 7. This is a decoder for 8421 BCD code, and as you can see it is somewhat simpler than if full decoding were used for each of the 10 outputs. Only the "0" and "1" outputs are fully decoded, while the "8" and "9" outputs have very simple decoding using 2-input gates. The remaining outputs use 3-input gates, which are still simpler than the 4-input gates which would be used for full decoding.

Yet if you trace through the logic, you will find that this decoder is quite adequate to decode 8421 BCD code. Each of the ten truth-value combinations which are "legal" in this code will produce a single and corresponding output.

Of course the problem with this sort of decoder is that if a code word becomes changed somehow into one of the truth-value combinations which are "illegal" in the code being used, the decoder will not handle it correctly. Most likely two outputs will respond at once, which can cause all sorts of trouble in following circuitry.

Because of this problem, minimal logic decoders like that shown in Fig. 7 are not often used nowadays. There are 10-output decoders made for BCD encoding, but these generally use full decoding for all of the outputs to prevent decoding errors. In effect they are simply truncated versions of the full 4-bit binary decoder of Fig. 6, with only 10 outputs in place of the full 16.

Incidentally although the decoders in Figs. 5, 6 and 7 are all shown having "true" outputs, which go to logic 1 when selected, this is not essential. Many practical decoders are made to have "false" or "active-low" outputs, which go to the logic 0 level when selected. This is done simply by using NAND gates for the decoding, instead of AND gates.

Decoders of both types are made and used, as each has advantages in certain applications. It depends largely upon the

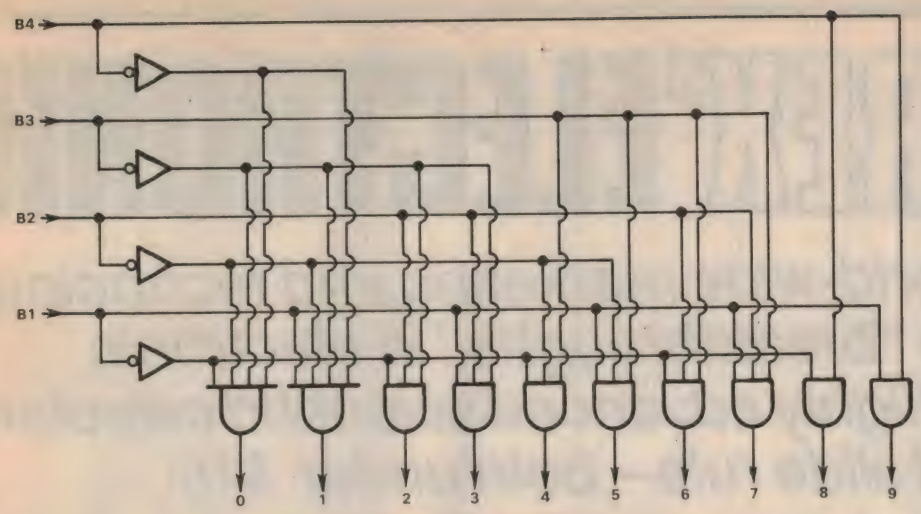


FIG. 7 : MINIMAL-LOGIC 8421 BCD DECODER

circuitry or devices which are to accept the decoded information — whether it can most easily cope with the information in "active high" or "active low" form.

Before we leave the subject of decoders for the present, there is a further type of circuit which should perhaps be described. This is not really a decoder at all, although the circuits concerned are usually described as such for convenience. There are only two common varieties, described respectively as the "BCD to 7-segment decoder" and the "hexadecimal to 7-segment decoder".

As the names suggest, these circuits are used to accept either BCD or hexadecimal information encoded in 4-bit form, and produce signals capable of driving one of the various types of 7-segment display device. We will look at display devices in the next chapter, and it would not be appropriate to describe 7-segment displays here in detail. For the moment it should be sufficient to visualise them as having seven display segments arranged in a "squared-8" pattern, so that by activating the appropriate segments a variety of symbols may be displayed.

Fig. 8 shows how a "BCD to 7-segment" decoder is used to drive such a 7-segment display device from incoming information in 8421 BCD code. As you can see from the truth table, the "decoder" takes each incoming BCD code combination and produces signals on the seven outputs a-g, to produce the appropriate display. For example when the input code is 1010, the circuit produces a logic 1 at outputs a,c,d,f and g, to display a 5.

Of course what the circuit of Fig. 8 actually performs is not decoding, but code translation—it takes information in 4-bit BCD code and translates it into the special 7-bit code required to drive the display. The final decoding of the information into human-readable form takes place in the 7-segment display itself.

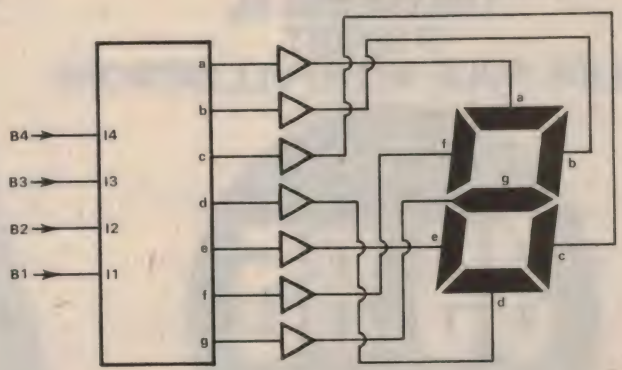
Similarly a "hexadecimal to 7-segment decoder" takes incoming 4-bit binary code, and generates the appropriate combinations of output truth values to produce the 16 appropriate hexadecimal display symbols—in slightly modified form. Apart from the familiar decimal symbols 0-9, the additional hexadecimal symbols are displayed as "A", "b", "C", "d" and "E"—the two lower-case symbols being used to avoid confusion with the numerals 8 and 0.

In short, then, a "hexadecimal to 7-segment decoder" is again not really a decoder at all, but a code translator.

Both 7-segment translator circuits tend to be grouped in with true decoder circuits because they are used in similar applications.

Finally, it should be noted that in addition to providing basic decoding circuits of the type shown in Figs. 5, 6 and 7, some manufacturers also provide integrated circuits which combine a decoding circuit with a set of flipflop latches, capable of performing storage.

Such "latch-decoders" may have the storage latches either before or after the decoding circuitry, although it is more common for the latches to be on the input side as this requires fewer flipflops. But both types of latch-decoder have their uses, as many decoding applications also call for the decoded information to be stored for some finite time.



INPUT CODE				DECIMAL	SEGMENTS DRIVEN						
B1	B2	B3	B4		a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
0	1	0	0	2	1	1	0	1	1	0	1
1	1	0	0	3	1	1	1	1	0	0	1
0	0	1	0	4	0	1	1	0	0	1	1
1	0	1	0	5	1	0	1	1	0	1	1
0	1	1	0	6	0	0	1	1	1	1	1
1	1	1	0	7	1	1	1	0	0	0	0
0	0	0	1	8	1	1	1	1	1	1	1
1	0	0	1	9	1	1	1	0	0	1	1

FIG. 8 : INTEGRATED 8421 BCD TO 7-SEGMENT DECODER— WITH DRIVERS AND DISPLAY

An example is in frequency counters, where the BCD output of each decade counter is normally fed via a latch-decoder to the display device. The storage provided by the latches allows each count to be displayed while the next count is taking place, so that each reading is stable and readable until it is replaced by the next.

In early counters which used a plain decoder without latches, each reading only lasted a short time before the display "rolled again", as the counter began the next counting. This made the early instruments quite difficult to read at times, compared with modern instruments having latch-decoders.

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Books & Literature

Solid state colour TV

SOLID STATE COLOUR TELEVISION CIRCUITS by G.R. Wilding. Newnes-Butterworths, London, 1976. Hard covers, 195 pages, 234 x 154mm, illustrated by numerous circuit diagrams. Suggested price in Australia, $12.50.

For those struggling to make the transition from valves to solid state and, almost simultaneously, from monochrome to colour, this book could be a most valuable reference.

Its most useful role would seem to be to provide a bridge between the student's purely theoretical studies, and the details of practical receiver design.

The first chapter—Devices and Principles—is worthy of particular mention. It occupies 28 pages and is almost a condensed course in solid state in its own right. The first 16 pages are devoted to bipolar transistors followed by FETs, zener diodes, varicap diodes, NTC resistors, PTC resistors, thyristors, diacs and triacs. All these devices are described with a nice balance between basic principles and practical uses and circuitry.

The rest of the book is devoted to specific sections of the colour TV receiver, as indicated by the chapter headings: Power supplies, Timebase Circuits, Sync Separators, Convergance and Degaussing, Tuners and IF Amplifiers, Luminance Circuits, Chrominance Circuits, Burst Gates and Reference Oscillators, Demodulator and PAL Switch Circuitry, Signal Amplifying and Output Stages, Beam Limiters.

While it is not possible to summarise all these chapters, one, in particular, impressed me. This is the "Tuners and IF Amplifiers" section which, among other things, deals with the latest varicap tuned and touch control type tuners—types which have only recently appeared on the Australian market. Apart from anything else, it suggests that the book is right up to date.

In all the chapters the author strikes a nice balance between basic principles, using explanatory circuits, and the practical application, using portions of typical commercial circuits. As with any such book, it will be most beneficial when studied in a situation where the reader has access to sets employing at least some of the circuits described.

All in all, a book well worth considering by anyone making an in-depth study of current colour TV receiver design trends.

Our copy from Butterworths Pty Ltd, 586 Pacific Highway, Chatswood, NSW, 2067. (P.G.W.)

Equivalents guide

TRANSISTOR EQUIVALENTS. 9th Edition. Published in the Netherlands by De Muiderkring B.V., 1974. Stiff paper covers, 300 (approx) pages 175 mm x 125 mm, mainly tabulated data. Price in Australia $5.50.

The problem of reviewing this book lies largely in the fact that the above description contains most of the things that need be said about it. It is, in fact, a listing of equivalents, with little other information on the individual types than silicon/germanium, NPN or PNP. It is intended to be used in conjunction with other books giving detailed characteristics.

My guess is that about 10,000 transis-

tors are included in the basic list, each followed by simple classification, as above, and up to about a half-dozen approximate equivalents from European, American and Japanese sources. The last 50 pages, printed on distinctive blue paper, presumably represent a supplement containing newly added types.

The book was first published in 1967 but the fact that this is now the ninth edition is testimony enough to its usefulness. Our copy came from Dick Smith Electronics (Cat No B2066), 162 Pacific Highway, Gore Hill, NSW. Mail orders to P.O. Box 747, Crows Nest 2065. (W.N.W.)

Video terminals

TV TYPEWRITER COOKBOOK, by Don Lancaster. Published by Howard W. Sams, Inc., Indianapolis, 1976. Soft covers, 214 x 135mm, 256pp, many illustrations. Recommended retail price $11.95.

Written primarily for the microprocessor enthusiast, this latest book by well-known US technical writer Don Lancaster deals with video terminals and other peripherals. It is both an introduction to their operation and a practical design guide, and provides quite a lot of useful information on standards and established techniques.

Not all of the material would be directly applicable here, because of the differing TV standards, etc. Also some of the sections are rather sketchy to my mind, and gloss over quite significant problems. An example is the section on ASCII-Baudot conversion, which makes no mention of the complications caused by the 110/50 baud speed difference. Nor does the section on cassette tape interfacing deal with serial data interface to systems—much harder than a parallel interface as given.

Still, a very useful reference for those dabbling in microprocessors.

The review copy came from Prentice-Hall of Australia. (J.R.)

PC boards

GUIDE TO PRINTED CIRCUITS, by Gordon J. King. Published by Fountain Press, London, 1971. Hard covers, 144 x 223 mm, 140pp, many illustrations. Recommended retail price $9.00.

Well-known UK technical author Gordon King has aimed this book at the amateur enthusiast, service technician and student. It is a basic introduction to PC boards and their use, with a strong emphasis on the practical side. There are chapters on basic PCB technology and fabrication, together with practical sections on home etching and servicing techniques. The text is clearly written and well served by illustrations.

In short, a worthwhile reference. The review copy came from Thomas C. Lothian Pty Ltd, publishers' agents. (J.R.)

New Products

New Nipper 48 colour TV performs well

Nipper 33, Nipper 43 and Nipper 48 are three new solid-state colour television receivers which will feature in the HMV range for the new year. We review here the largest of the three, Nipper 48, having a 48 cm (or 20in) diagonal screen measurement.

In introducing the new models, the EMI Group stresses that they should build up an even higher reputation for simplicity of installation and reliability than even the popular 18-inch HMV "Braddon" reviewed in these pages in November last year. Since that time, the Company's warranty on colour sets has been extended to 12 months on parts and labour, and the base cost of subsequent insurance has tumbled to about one third – a most attractive proposition.

To emphasise the relative freedom from installation problems, EMI simply delivered one of the new Nipper 48s into a typical suburban home situation, no carton, and carried in by one not-very-large man. (At 29kg, it can be manhandled without too much effort). The rather puzzled company representative was told merely to deliver the set and literature, obtain the necessary signature and take his leave. The 'householder" would be the person to connect it up and switch it on.

Which I did, in due course, standing it alongside another colour set of known performance, so that I would have some basis for comparison. A length of cable with in-built splitter ensured that the two would have adequate and identical signals on all channels.

At switch-on, EMI had made their first point! The set immediately produced an excellent set of pictures from all four local channels, with no attention to the AGC or fine tuning, and with not hint of any problems with purity or convergence.

Fairly obviously, it was a set that could be moved around, physically and electrically, without too much hesitation, needing only an appropriate aerial connection to provide first rate pictures. The set has provision, by the way, for either 300-ohm or 75-ohm aerial connection, with an in-built 18dB attenuator facility for strong signal areas. For future UHF reception a separate 300-ohm UHF aerial would be required.

At right is the new Nipper 48 colour TV receiver. A column stand with castors is available as a separate item. Secondary controls are accessible behind a door to the right of the picture tube. The receiver below is the baby of the new range, the Nipper 33.

One personal impression is worth mentioning at this point. Having a 26-inch receiver in the home for normal viewing, my reaction to small colour sets tends to be one of non-enthusiasm; as with colour slides and colour movies, the bigger the screen, the better I like it. But while the 20-inch screen was obviously smaller than the 26-inch, I had to concede that it was no longer "little". Compared with even an 18-inch, the extra couple of inches are well worth having.

And there's one other thing that impresses immediately: the Nipper 48 has a quick heat picture tube, and one no sooner switches the set on than the picture comes up to match the sound. The picture tube would appear to be a 90-degree type to judge by the overall depth of the cabinet (462mm) but the smaller angle does tend to minimise power consumption (90W total) and to be less exacting on the deflection circuitry.

Although I could find no hint of the fact in the literature, the receiver is manufactured overseas to EMI requirements, conforming completely with local practice: isolating mains transformer, X-Ray protection circuitry, aerial isolating capacitors and flame retardant cabinet back. Electrically, the design conforms to recommendations of the Australian Broadcasting Control Board, employs full Pal-D circuitry, and is set for the local standard white point of 6500 degrees K.

Channel selection for VHF is by ordinary rotary switch, with a concentric knob for fine tuning. In fact, the fine tuning will rarely need to be touched, because the receiver employs full automatic frequency control, which is normally left switched in. The channel selector is provided with an illuminated indicator and, when turned to channel 11 (it actually reads 11/U), a light appears behind the UHF tuner dial as well, indicating potential coverage of UHF channels 21 to 69.

The only other obvious controls on the front panel are for volume, with push-pull off-on switch, and a locking push-button which increases the brightness for daylight viewing. Closer inspection will, however, reveal two tiny sockets low down, near the speaker grille: one for an earphone (supplied with the set, with 3m of cord) and the other for a tape recorder output.

All other controls—colour, brightness, contrast, and AFC switch—are behind a door in the front panel, indicating that once set, they can largely be forgotten.

Other details could be listed if space were available but they can be obtained from sales literature covering the receiver. Of more immediate interest are the finer points of its performance. We've already said that it worked well

without on-the-spot adjustment; but how well?

In part, the reduced need for on-the-spot adjustment is due to the use of a vertical slot type picture tube in place of the older dot-pattern, delta gun type. The advantage can be bought rather dearly, however, if the vertical slots (or stripes) are too coarse, since they can reduce effective definition and be seen as a vertical line pattern—at least by those with keen vision. In fact, the slots in the Nipper 48 picture tube are quite narrow and give no cause for such criticism. Definition of detail was right up to standard.

We felt that the highlights were initially a trifle too bright, even with the brightness turned down, but this was corrected by a nudge of the sub-brightness control —a screwdriver adjustment accessible through the front panel and the sort of thing the installer would probably have reset, had he been given the chance at the time of delivery.

We also felt that the contrast could have come down a little further than the control permitted and this was verified when we were able to catch a test pattern. The last step in the grey scale was being crushed somewhat, but this was something we elected not to fiddle with.

With the test pattern available, we were able to note that the basic vertical and horizontal grid was indeed rectangular, substantially free from pincushion effect, and completely free from any interference between the video signal and line sync. The centre circle was free from any hint of irregularity but it did measure 30 cm wide by 29 cm high, indicating the need for a slight reduction in width.

For all practical purposes, the colours in the test pattern were identical with those on the known reference receiver and, after all the hoo-haa about white point settings a few months ago, we were happy to record that there was no discernible difference between the two. In fact, apart from the slight crushing in the shadows mentioned earlier, the pictures were virtually identical in colour values and definition.

To sum up, our impression of the Nipper 48 is that it is an excellent receiver and very well suited to domestic situations were a small set would be inadequate, but where a 26-inch model would be too cumbersome and too costly. Performance, as delivered, was excellent, and faulted in minor detail only because we were able to make side-by-side comparison with another known receiver.

If noticed at all under other circumstances, such detail could readily have been attended to during normal installation or follow-up.

Recommended retail price for the Nipper 48 is $663. Further information can be obtained from EMI dealers around Australia or by mail from EMI Aust Ltd, P.O. Box 32, Homebush 2140. (W.N.W.)

INFRA-RED INTRUDER ALARM

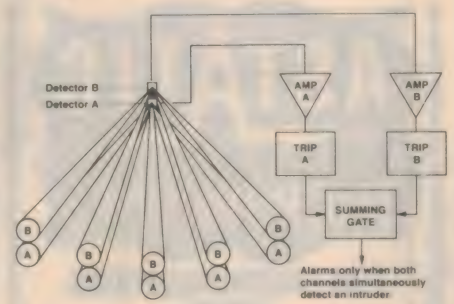
Housed in an attractive, tamper protected housing, the Raytek BiSpy model 8500 passive infrared intrusion detector can monitor a sector of free space measuring 80 degrees by 25 feet. Up to six slave units can be controlled by the master unit.

Infrared intruder detectors operate by sensing the change in level of infrared energy caused by the entry of an intruder into the protected area. As shown in the diagram, the BiSpy optical system divides the protected area into five zones, each of which is monitored simultaneously by two independent detectors.

Two independent infrared detectors (using the same optical system) are built into each sensing head. Output signals of the two detectors are processed through separate amplifiers and trip circuits before being compared by a summing gate. Unless both channels simultaneously detect an intruder, the system will not alarm.

This means that false alarms cannot occur due to electrical interference or intermittent component failure in either channel. By having the sensing area divided up into zones, it is also possible to aim the unit so that heat producing objects such as hot air vents fall between the zones, and thus do not cause erroneous alarms.

In order to facilitate such aiming, the unit is provided with a "walk test" provision. After mounting the unit in



The BiSpy system uses two detector channels, also wide-angled detection zones.

position, a slider switch on the front of the unit is moved to the appropriate position. The installer can then walk about the covered area, and check that the alarm is triggered in the appropriate places. This is indicated visually by a small LED on the front of the unit.

The unit operates from a 12V power source, which can be either AC or DC. Current consumption is 50mA. A 12V 0.5AH nickel—cadmium standby battery can be fitted inside the case. This gives a standby time of eight hours.

The alarm relay has single pole double throw contacts, which are rated at 0.06 amps at 130VDC. The tamper switch has similarly rated contacts.

Measuring 190 x 140 x 90mm, and weighing only 1.1kg, the unit is mounted in an attractive intercom styled plastic

The Raytek BiSpy model 8500, which uses a passive infra-red detection system.

case. Slave units are identical in size, but of slightly lesser weight.

The unit is intended to be mounted against a wall, with screws through the back plate. Access to these screws is obtained by removing the front cover, which then activates the tamper switch. This can be either wired in association with the alarm circuit, or independently of it.

Up to six type 8520 slave units can be used with the 8500 master unit. These slaves receive their power from the master unit, and when an intruder enters their field of view, they trip the alarm relay in the master unit. With six slaves in operation, the standby time is reduced to a minimum of four hours.

Other models of both master and slave units are available with long range coverage. The slave units are connected in parallel with 4-conductor shielded signal wire. If the tamper switches are utilized, 6-conductor wire is required.

Units are also available for concealed and in-wall mounting. The 8500 master unit in both wide range and long range versions sells for $264.37 plus tax. The price for larger quantities is $218.10 each plus tax. Slave units in one off quantities cost $176.96 plus tax, while for larger orders the unit cost reduces to $145.99 plus tax.

Standby batteries are obtainable for $29.55 plus tax, while slaving cable sells for 35c per foot, plus tax. Inquiries should be directed to the Australian agents, Currency Handling Systems (Australia) Pty Ltd, 28-30 Langley Street, Darlinghurst, NSW 2010. (D.W.E.)

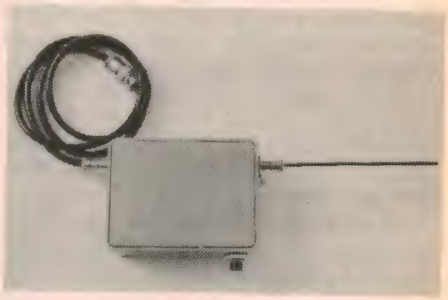
NEW PRODUCTS

Wide band preamp for instruments

The WB250 Wide Band Amplifier is a rather unusual piece of equipment offered by Bright Star Crystals. The main use for this unit is to increase the effective sensitivity of frequency counters. Also, because no actual connection is made to the equipment to be tested, oscillators may be measured without interfering materially with the actual frequency. This can be a decided advantage, as when actual connection has to be made to an oscillator, the frequency may be shifted to a marked extent, thus giving a false reading.

The device is a battery operated transistorised wideband amplifier, housed in a handy size metal box. The input sensitivity is quoted as 500uV, with an output of 100mV. The bandwidth is quoted as from 100kHz to above 500MHz. However, a check which I made at the low frequency end showed that the response started to fall off significantly at about 300kHz. I understand that by increasing the size of coupling capacitors in the unit the low frequency response can be somewhat improved.

Another check made on an oscillator operating between 3.5MHz and 4.0MHz indicated that the device does what is claimed for it. By placing the probe near



the oscillator and connecting the output to a counter or a CRO, a good indication was obtained in each case.

I found the unit easy and convenient to operate, with the case fitting comfortably in the hand, with the push-button switch in the right place. In short, then, this device should be of considerable value to anyone involved with low level oscillators and similar circuits and the need to make measurements on them.

An additional feature is available as an option. An inbuilt marker can be supplied for 455kHz, 10.7MHz, or 29.798MHz. I imagine that other frequencies could be supplied on special order.

Further details from Bright Star Crystals Pty Ltd, 35 Eileen Road, Clayton, Victoria 3169. (I.L.P.)

Video Technics TV Tuner

Designed specifically to mate with colour and B&W video recorders, the Video Technics Colour TV Tuner has facilities for VHF and UHF reception. It is especially useful when more than one program has to be monitored and recorded at the same time.

The Video Technics Tuner is accommodated in a wide shallow case with up-to-the-minute styling. It has a black perspex dial with windows for tuning meters and the case is timber with a simulated woodgrain finish. Dimensions are 482 x 90 x 305mm (W x H x D).

Coverage is provided for all Australian VHF television stations plus UHF channels 25 to 68. Antenna inputs are 75 ohm coax socket for VHF and 300 ohm twinlead socket for UHF. Outputs are a J-standard 8-pin socket for connection to video recorder, BNC connector for video line output and 6.5mm jack socket for audio line. Video output is 1 volt peak-to-peak and audio output is 700 millivolts RMS with low output impedance.

Basically, the instrument consists of separate VHF and UHF tuner modules together with the necessary power supplies, and IF and detector circuitry to provide the video and audio outputs. The IF and detector circuitry is housed in a tinplate enclosure and the power supply circuitry is on a separate PC board. A standard 3-core mains flex and 3-pin mains plug is fitted.

The Video Technics tuner is designed and manufactured in Australia by Video Hifi Centre who can demonstrate the unit and provide information on performance and price. Their address is 2nd Floor, Telford Trust Building, 79-85 Oxford Street, Bondi Junction, NSW 2022.

Puncture Tester

Pictured below is a new high voltage puncture tester made by Tech Instruments Company Ltd, of Japan. It is basically an adjustable high voltage AC power supply with presettable cut-off current (from 0.5 to 10 milliamps). A component to be tested is connected across the terminals and voltage applied. If the preset current is exceeded, a buzzer sounds and an indicator lights. At the same time, the supply voltage is automatically disconnected from the terminals. A reset button returns the tester to normal operation for the next component to be tested.

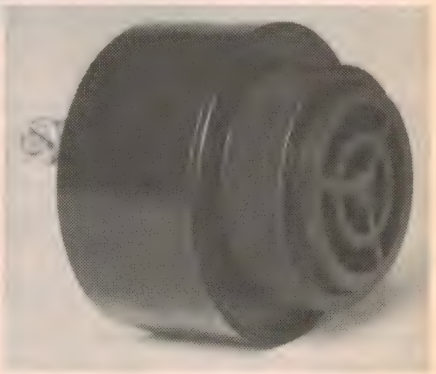
Further information on price and availability can be obtained from the distributors, University Graham Instruments Pty Ltd, 106 Belmore Road, Riverwood, NSW.

NEW PRODUCTS

Audiolarms from C&K

A new series of small, low cost solid state alarms has been introduced to the Australian market by C & K Electronics. The Bell "Audiolarm" range of devices is claimed to operate in hostile environments, unaffected by extremes of humidity, vibration, altitude or salt spray.

All models produce a shrill, penetrating sound, and operate on a wide range of supply voltages. No RF noise is produced during operation, as no mechanical parts are involved in sound generation.



Sound levels of up to 95dB can be produced by most models. Some models operate continuously, while other can be made to pulse on and off. Models are also available which can be controlled by logic signals.

Further information can be obtained from the Australian distributors, C & K Electronics Pty Ltd, PO Box 101, Merrylands, NSW 2160.

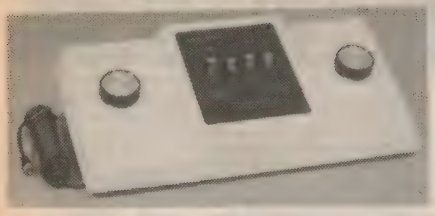
CB dealers wanted

Dick Smith Electronics Pty Ltd is confident that the PTT Department will soon approve CB radio in Australia. So confident that it is seeking reseller/dealers throughout the country for the Midland range of CB equipment, for which it is the Australian agent. Midland Electronics is claimed to be CB industry market leader in the US.

Equipment designed for the CB band may only be operated legally in Australia at present by radio amateurs and those who have been granted a permit by the PTT department. However there are no restrictions on the sale of equipment.

DSE believe they are one of the few firms in Australia at present who have the knowhow, spares and servicing facilities to make selling CB radio a profitable venture. They invited anyone interested in becoming a Dick Smith/Midland Dealer to write to Gary Johnson, D.S. Distributors, PO Box 747, Crows Nest NSW 2065.

Video game



The Video Sport game provides for four games: tennis, squash, handball and football/hockey. It provides sound effects for hit, wall bounce and score, and also has automatic on-screen scoring. Playing speed and bat size are both variable, and playing area is visually defined on-screen.

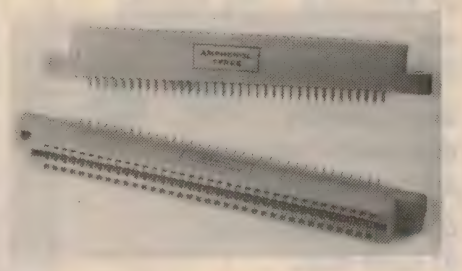
The unit operates from six standard D type cells, and complies with specifications published by the PTT Department in terms of RF radiation.

Priced at $79.50, the Video Sport is available from Farad Sales Pty Ltd, of 212 Balaclava Road, Caulfield, Victoria 3161. Mail order sales accepted.

Edge connectors

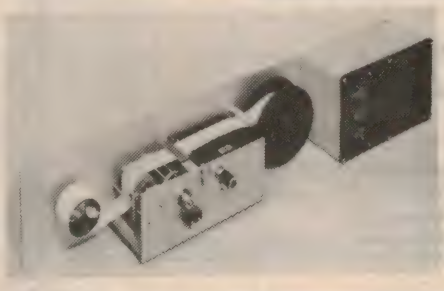
Locally manufactured PC edge connector sockets of any required length up to 85 connectors per side are available from Amphenol Tyree. The series 225A connectors can be single or double sided, with either 0.1in or 0.156in spacing between contacts. The contacts are made from a new high tensile material and are available with gold plating of 0.5, 0.76 or 1.2 microns as desired, with various tail options.

Further information from Amphenol Tyree Pty Ltd, 176 Botany Street, Waterloo, NSW 2017. Telephone (02) 69 5364.



Paper tape punch

The MACE patented tape punch shown below is a low cost, low power unit designed for unattended remote data recording. It is available from Measuring and Control Equipment Co. Pty. Ltd., 9 Mobbs Lane, Carlingford, NSW 2118. Telephone (02) 858 3878.



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Certain provisions of the Trade Practices Act 1974, relating to consumer protection place a heavy burden upon advertisers, advertising agents and publishers of advertisements.

Section 52 of the Act imposes a general duty on everyone (individual and corporation alike) not to engage, in trade or commerce, in conduct that is "misleading or deceptive."
In addition Section 53 (read with Sections 6 (3) (c) and 79) makes it a criminal offence (punishable in the case of an individual by a fine of $10,000 or 6 months' imprisonment and in the case of a corporation by a fine of $50,000) for an individual or corporation to do any of the following in trade or commerce in connection with the supply or possible supply of goods or services or in connection with the promotion by any means (for example advertising) of the supply or use of goods or services, namely:–

"(a) falsely represent that goods or services are of a particular standard, quality or grade, or that goods are of a particular style or model;
(b) falsely represent that goods are new;
(c) represent that goods or services have sponsorship, approval, performance characteristics, accessories, uses or benefits they do not have;
(d) represent that the individual or corporation has a sponsorship, approval or affiliation [he, she or] it does not have;
(e) make false or misleading statements concerning the existence of, or amounts of, price reductions;
(f) make false or misleading statements concerning the need for any goods, services, replacements or repairs; or
(g) make false or misleading statements concerning the existence or effect of any warranty or guarantee."

Apart from the criminal sanction for a breach of Section 53, an individual or corporation infringing Section 52 or 53 is liable to proceedings for injunction and for damages suffered by an injured party. In view of the obvious impossibility of our insuring that advertisement submitted for publication comply with the Act, advertisers, and advertising agents will appreciate the absolute need themselves to ensure that the provisions of the Act, including the sections specified above, are complied with strictly.
It is suggested that in cases of doubt advertisers and advertising agents seek legal advice.

SUNGRAVURE PTY. LTD.

NEW PRODUCTS

TWO NEW CALCULATORS FROM UNITREX

Two new calculators, recently announced by Unitrex of Australia Pty Ltd further dramatise the ever-increasing ratio between the facilities offered and the buying price in dollars. Both are attractively styled, both have click-type buttons and both offer facilities which, until recently, would have been found only in much more costly calculators.

The simpler of the two, the Unitrex 95SL, is described by the manufacturer as a "Slide-Rule" Calculator and is intended for students, handymen, technicians or engineers, who might hitherto have relied on slide rules, tables—or long-hand calculations!

It is basically a 4-function calculator in which the numerals, plus, minus, multiply/ divide and equals remain relatively uncluttered. It is therefore appropriate for use by people who want it only for simple tasks.

However, a percentage key provides a direct mark-up or discount facility for sales counter use, while a "constant" key offers another approach to problems. ay

For mathematical tasks as such, chain and mixed calculations are possible, with multi-function keys to provide square root, square and reciprocal. The decimal point is fully floating and, when overload occurs, the calculation is not lost; pressing the C button once shifts the decimal point eight places to the right, conserving the most significant digits.

There is also a memory function controlled by four keys: M+, M-, MR, MC and MEX.

The 8 digit display is a bright red, clearly visible in full room lighting. The digits are optically enlarged by the bezel to an equivalent of about 4mm, with the one disadvantage that they are clearly visible only to the person using the calculator.

The sample submitted for review was accompanied by a simple folder explaining its main functions. It was intended to operate with a 9-volt "transistor" style battery (or external supply) and drew 12.5mA at switch-on, building to 35mA as "8" numerals were displayed.

Advertised base price of the 95SL calculator is $9.95 (not including battery) to which must be added $2.50 to cover mail order handling and postage.

The 95SC "Scientific" pocket calculator is similar in appearance but has 8 digits plus a 9th position to indicate status. Optical magnification would appear to be less, making the digits appear slightly smaller and sharper. A 9V battery is specified, again with access for an alternative supply. Quiescent current was measured at 20mA, rising to 40mA with all digits energised, but falling back to 20 when the automatic fade-out operates.

While intended primarily for those needing a mathematical facility, the 95SC can be used in a simple 4-function arithmetic role, by ignoring the secondary markings. However, it does not have a direct percentage or "constant" facility, requiring the informed user to arrive at the same answers by a slightly more devious route.

As will be apparent from the pictures and the advertisements, all keys have a dual function and, nowadays, likely users of this type of calculator will be able to judge their suitability for a particular role by examining the key notations.

Perhaps the surprising thing about the 95SC is its price: a base figure of $14.99

Above: the 95SL. Below: the 95SC.

(not including battery) to which must be added $2.50 for mail order handling and postage. Packaged with the calculator is a small instruction booklet.

Both calculators are being offered through the Reader Service Dept of our parent company John Fairfax Ltd, phone (02) 20-944 Ext 303. They are obtainable only by mail order, details being given in advertisement elsewhere in this issue.

Letters to the editor

Quartz standard

A copy of your review of our Oscilloquartz Frequency Standard, published in the August 1976 issue, was forwarded to us by our Australian representatives. We are quite pleased with the generally positive presentation given by the author. However, the article contains some fundamental misconceptions and mistakes which should be corrected in justice to your readers.

First, with regard to precision (para. 6). Since the frequency of the standard can be adjusted relative to a given reference, the precision (accuracy) at the moment of setting the oscillator will be within the specification for settability, i.e., less than 2 parts in 10E-10. Therefore its later precision (accuracy) will be determined by the relative frequency change with the passage of time.

The time error shown by the 2200 when compared to a standard time reference, e.g., atomic time as internationally defined, will to first order consist of a time error due to the frequency offset from the reference, and one due to the ageing rate of the oscillator times the square of the elapsed time (see Barnes; Proc. IEEE Vol. 54 No. 2, Feb. 1966, pp 207-220). Thus the value quoted by the reviewer in paragraph 6 is incorrect.

In measuring frequency fluctuations between two oscillators, it is impossible to determine the individual characteristics of either oscillator without a third as reference. When the 2200 was compared with the NWC reference using a dual beam CRO, as described in paragraph 10, what was the reference? Again there is a non-precise use of words here, for to measure a "frequency drift" of 1 part in 10E-8 is very difficult in a short period of time.

We hasten to point out that within four hours after turn-on, 1 part in 10E-8 frequency "drift" of the 2200 for some undefined measurement interval may not be so bad at all; nor, for that matter, is the same order of frequency difference. We agree with the reviewer that the result is of dubious validity. When the 2200 oscillator is turned on from a cold condition, it is quite repeatable in its transient frequency characteristics, and this is confirmed by the reviewer. In fact we use this characteristic in our model 3200 Cesium Frequency Standard for effecting the automatic lock capability.

We appreciate the presentation of our instrument in such an important publication in Australia. At the same time we believe it important for all concerned that any inaccuracies and incorrect statements be corrected.

Oscilloquartz, S.A.
Neuchatel, Switzerland.

COMMENT: As you point out yourself, our reviewer took care to note that limited time and modest facilities prevented us from testing the 2200 either as extensively as it deserved, or when it had fully stabilised. He also noted that despite this, its very consistent turn-on characteristic and the measures of performance we could take gave every confidence that it would easily meet its specs when fully stabilised.

Electronics club

When I arrived in Brisbane as a transplanted Canadian five years ago, I was very disappointed at the lack of electronic components available. Electronics shops catering for the hobbyist were few and far between, and very scantily stocked. Recently, however, with the arrival of Dick Smith, Techniparts, Tandy and others there has been a very welcome expansion.

I feel that there is another need to be filled — an electronics hobbyist's club. Somewhere members could gather to trade circuits, talk electronics and perhaps use expensive equipment belonging to the club which would be beyond the finances of individuals. For a beginner whose new home-built oscillator refuses to work, a few old hands within calling range could mean the difference between going on to bigger and better things in electronics, or giving it away altogether.

With this idea in mind, I would like to organise an Electronics Hobby Club here in Brisbane, and wondered if Electronics Australia would consider printing my name, address and telephone number in order that interested hobbyists could contact me.

Frank Halliwell
10 Nidalla Street,
Macgregor, Qld. 4109 (Tel. 349-9834)

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

synthesised SSB $245

27MHz

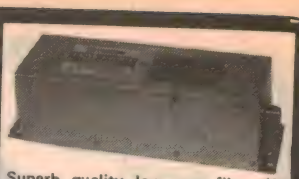
This superb rig is the ultimate in quality and sophistication! The CB1000 is synthesised and requires no crystals - accuracy is within 0.001%! There are 69 available modes, 23 AM, 23 LSB, 23 USB at 5 watts AM and 15 watts pep. Runs from 13.8 vdc either positive or negative earth. Controls include squelch, rf gain, clarifier, noise blanker (FR type) and transceiver PA system swich. Front panel meter indicates "s" points or RF output. The rig comes complete with mic, mobile mounting brackets, dc cable and VICOM 90 dav warranty. A real bargain!

BUILT-IN SWR BRIDGE!

NEW $140

COUGAR 23 B AM DELUX TRANSCEIVER

Delux mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitary consists of 1 IC, 20 transistors, 18 diodes. RECEIVER: dual conversion, sensitivity 0.5 uV for 10 dB S+N/N, selectivity 6 dB bandwidth 5 kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55 dB. Comes complete with mic, mobile bracket, dc cable and manual.



Superb quality low pass filter (34 MHz cut-off) will handle up to 1 kW pep. 50 ohms impedance with insertion loss better than 0.3 dB. Copper construction with SO239 sockets. **$29**

TVI PROBLEMS ? * *

HF TRAP DIPOLES

AL48DXN 40 & 80 metres, length 28 metres	$ 40
AL24DXN 20 & 40 metres, length metres	$ 40
MIDY VN 80 thru 10 metres, length 23 metres	$ 48

DUMMY LOAD

3 watt lighted dummy load fitting into UHF (PL259) plug. Glows when transmitter is on - making this handy accessory ideal for transmitter tuning and tesing. $2.50.

GET THOSE EXTRA "S" POINTS!

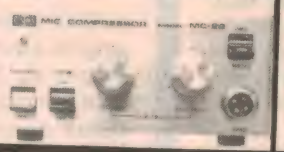
Popular VC2 swr/pwr meter operates 3-150 MHz with power measurement 12/120 watts. Will handle up to 1000 watts. 50 ohms impedance, twin meters. A bargain! $29.80

SWR/PWR METER $29.80

QUALITY MIC COMPRESSORS

Increase average "Talk power" by connection to the transmitter microphone circuit for sideband transmitters-MODEL MC33A ac/dc includes 2 tone generator and built-in compression- level meter.

$65



ANTENNAS SALE

¼ WAVE HIGH EFFICIENCY GROUND PLANE
Solid heat-treated aluminium construction, rugid, terminated to SO239 socket $28.50 + P&P $3

27 MHz Helical Ground plane Antenna
A GROUND PLANE WITHOUT HASTLES!
Teflon wire wound on light and strong fibreglass rod $65 + P&P $3

27 MHz TRUCK ANTENNA
Twin centre loaded mirror mounted antennas especially designed for truck use. Comes complete with cables, plugs, connecting brackets, $34.50 + P&P $3

MODEL M1 27 MHz MOBILE WHIP
Base loaded stainless-steel mobile whip, 40.5 inches, 50 ohm impedance, vswr less than 1.5. Includes roof-top mount, optional boot lid mount, spring and coax with PL259 plug. Tensile strength 260,000

$22

MODEL G2 AS ABOVE WITH GUTTER CLAMP $24.50

27 MHz Helical Ground plane

amateur gear

Ringo-Ranger ARX2, three half waves 6 dB gamma loop matched vertical	$ 40
AS210BN 2m beam, twin boom 10el each boom, 18 dB gain, F/B 20 dB, length 4m, weight 6.8 Kg	$ 99

HF MOBILE ANTENNAS

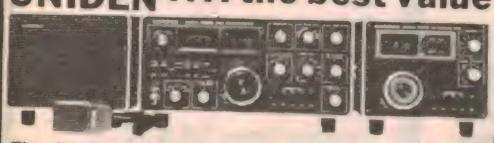
AS303A Antenna Set 80 thru 10 metres, centre loaded, incl heavy duty ball mount and spring $105

Quality Hustler Resonators. Precision would with optimum design for each band, adjustable trip rod for lowest swr:

RM80 (80 metres)	$26 RM20 (20 metres)	$20
RM40 (40 metres)	$25 RM11 (11 metres)	$24
BM1 Bumper mount	$15 RSS-2 spring	$12

Why take the gamble? All rigs sold by VICOM are given a thorough pre-delivery checkout supported by technical expertise and well equipped workshops. Spare parts are available too!

UNIDEN .... the best value

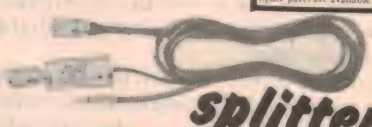


The fabulous UNIDEN 2020 (MK11) PLL transceiver offers separate sub/lsb/cw 8 pole crystal filters as standard and 6146B's in the final with screen voltage stabilisation for minimum distortion products. Features plug-in pcb's and even the front panel can be swung out for easy servicing. This superbly engineered rig cover 80 thru 10 metres (incl. 11 metres) at 180w DC input ssb. Compare the UNIDEN 2020 with other HF transceivers and you'll be quickly convinced that it offers the best value!

2020 Digital transceiver	$649
Uniden digital VFO	$119

27 MHz/CAR RADIO SPLITTER

Permits operation of your AM or AM/FM car radio from a 27 MHz antenna. Can be used with any series fed (ungrounded) 27 MHz antenna. Finished with RG58/u and car radio high impedance lead, each 60 inches long. Excellent isolation between entertainment radio and 27 MHz transceiver. Includes adjustable 27 MHz matches for optimising SWR. $26 + P&P $1.50

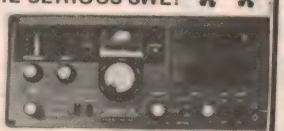


splitter

RECEIVERS FOR THE SERIOUS SWL!

Yes, the famous Barlow Wadley general coverage receiver with crystal controlled reception of am/lsb/usb/cw now includes the Australian FM band!

BARLOW WADLEY STANDARD	$269 + P&P
WITH FM	$298 + P&P



The new Yaesu FRG-7 general coverage receiver features ac/dc operation and the famous Wadley Loop principle with spin tuning and phase-locked synthesiser providing complete coverage from 500 KHz to 30 MHz with an accuracy better than 5 KHz. Please write for further technical details (enclosing SAE)

OUR PRICE **$275** + P&P

ANTENNAS

Listener 1 "V" type antenna. Covers 3-30 MHz with special trap. Ideal for DX reception. $21 + P&P

Listener 3 Long Range wire dipole antenna 3-30 MHz complete with balun, feed wax, VHF plugs, insulators. Ideal for the serious SWL $42 plus P&P

ICOM .... where quality counts!

IC215 HANDY FM PORTABLE

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, the ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really protable, while accessible features make conversion to external power fast and easy!

- Fully collapsible antenna
- 15 channels (12 on dial + 3 priority)
- Dual power 3 watts/40 mW
- Lighted dial and meter **$164**
- Crystals same as IC22 series

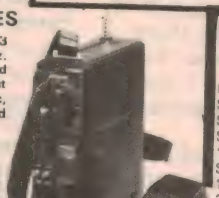
Your new IC215 comes complete with 3 popular channels, mic, shoulder strap, connectors, batteries, English Manual and VICOM 90 day warranty.

QUALITY HANDY PORTABLES

The famous IC202 handy portable runs 3 watts pep with VXO control 144-146 MHz. Features noise blanker, RIT, lighted dial and meter, telescopic antenna and of course that ICOM quality! Comes complete with mic, carrystrap, dry cells, English manual and 90 day warranty.

IC502 $175 IC202 $185

Six metres SSB using the IC502 can be great fun! This handy portable runs 3 watts pep ssb 52-53 MHz. Featuring VFO control, switch-cable noise blanker, RIT and provision for external power and speaker, 9 long-life C batteries, English manual and 90 day warranty.



SYNTHESISED! NO CRYSTALS

IC22S $220

NEW

The new IC22S transceiver is a PLL synthesised rig with programmable ROM for any frequency multiple of 25 KHz from 144 to 148 MHz. Simplex, duplex or reverse achieved by a flick of a switch on the front panel. This fabulous new rig features ceramic discriminator, IDC, electronic Tx/Rx relay, full swr protection and VICOM 90 day warranty. Circuitary includes 34 transistors, 7 FETs, 13 ICs and up to 128 diodes. Receiver sensitivity better than 0.4 uV for 20 dB quieting. Your new IC22S comes complete with mic, mobile mounting bracket, plugs, cables, spare diodes for programmable matrix and English Instruction Manual.

PLUGS AND SOCKETS FOR THE COMMUNICATOR!

(minimum mail order $5)

P1259 plugs with reducer	$1.20
SO239 chassis socket	$1.20
SO239/PL259 tr angle connector	$1.95
SO239 3 female "T" adapter	$2.00
"T" connector	$2.20
Solderless in-line splice	.90
18" coax jumper lead with PL259s	$2.00
3' coax jumper lead with PL259s	$2.20
3 pin mic plugs and sockets	$1.90
4 pin mic plugs and sockets	$1.90
RG58A/U 52 ohm coax - 45c/metre	
RG8 low loss coax - 45c per foot	

the COMMUNICATIONS SPECIALISTS!

VICOM

Cables & Telegrams "IZYCOM" Melbourne

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DEALERS:

Perth:	Netronics, 338 Huntriss Ave, Woodlands Ph 46 3232
Canberra:	The Electronics Shop (Daicom), 29 Colbee Court, Phillip, Phone 82 3581
Adelaide:	Graham Stallard, 27 White Ave, Lockleys, Ph 437981
Brisbane:	Elite Electonrics, 69 Wardell St, Dorrington, Ph 38 4480

Prices and specifications subject to change without notice. Prices include Sales Tax but exclude freight and Insurance. Allow 50c per $100, minimum $1

The Amateur Bands

by Pierce Healy, VK2APQ

Australian radio clubs

In presenting this year's list of amateur radio clubs we express the hope that it will benefit both the clubs and individual readers. Readers who wish to further their knowledge of amateur radio and electronics are advised to look up their nearest club and attend the next meeting. You will be most welcome.

Club name:	WIA, ACT DIVISION – CANBERRA RADIO SOCIETY.
Club call sign:	VK1WI, VK1ACA, VK1RAC.
Meeting place:	The Studio, Griffin Centre, Bunda Street, Civic, ACT.
Day and time:	Fourth Monday of each month at 8.00pm.
Affiliation:	Member of the Wireless Institute of Australia.
Net frequency:	Channel 6 repeater VK1RAC, Channel 50 & 7050kHz.
Contact:	Secretary Mike Vale, VK1VW, PO Box 1173, Canberra City, ACT 2601.

Club name:	HUNTER BRANCH NSW DIVISION WIA.
Club call sign:	VK2AWX; repeater channel 6 VK2RAN.
Meeting place:	Newcastle Technical College and Northumberland Radio Centre, Teralba.
Day and time:	First Friday of each month at NTC and third Friday of each month at NRC.
Net frequency:	3570kHz each Monday night at 7.30pm.
Contact:	Secretary, Ray Leban, PO Box 134, Charlestown. Bill Hall, VK2XT, telephone 59 1586.

Club name:	CENTRAL COAST AMATEUR RADIO CLUB.
Club call sign:	VK2AFY.
Meeting place:	Clubrooms, Dandaloo Street, Kariong.
Day and time:	First and Third Friday of each month 8.00 pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 3 repeater VK2RAG.
Contact:	Mrs S. J. Wells, PO Box 238, Gosford, NSW 2250.

Club name:	WAGGA DISTRICT RADIO CLUB.
Club call sign:	VK2WG.
Meeting place:	Wagga Rescue Club Rooms, Bolton Street, Wagga.
Day and time:	Last Friday of each month at 8.00pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 3 repeater VK2RWG.
Contact:	Secretary Frank Sleep, PO Box 71, Koringal, Wagga 2650.

Club name:	ILLAWARRA AMATEUR RADIO SOCIETY.
Club call sign:	VK2AMW.
Meeting place:	Wollongong Town Hall Meeting Room.
Day and time:	Second Monday of each month at 7.30pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 5 repeater VK2RAW.
Contact:	President Ian Bowmaker, VK2ZJA, PO Box 1433, Wollongong 2500, telephone 29 2158 or Keith Curle, VK2BUU, 24 Beach Drive, Woonona 2517, telephone 84 2469.

Club name:	ORANGE AND DISTRICT AMATEUR RADIO SOCIETY.
Club call sign:	VK2AOA.
Meeting place:	Orange Technical College.
Day and time:	Every Friday night 7.00pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 2 repeater VK2AOA/R.
Contact:	Pres. Robert Alford, VK2ZRJ, telephone 62 1544 (Bus), 62 4673 (AH), Secretary Allan Wright, VK2BVL, telephone 62 1432.

Club name:	OXLEY REGION RADIO CLUB.
Club call sign:	VK2BOR.
Meeting place:	As convenient to members.
Day and time:	As convenient to members
Affiliation:	NSW Division WIA.
Net frequency:	Club channel 2 repeater.
Contact:	Peter Alexander, VK2PA, PO Box 152, Port Macquarie, NSW 2444, telephone (065) 83 2033.

Club name:	WAVERLEY RADIO CLUB.
Club call sign:	VK2BV.
Meeting place:	1/6 Blenheim Street, Bondi Junction, or venue advised in VK2WI news broadcasts 11.00am and 7.30pm Sundays.
Day and time:	Second Thursday each month at 8.00pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 6 repeater VK2RBV.
Contact:	Secretary Phil Card, VK2ZBX, telephone (AH) 389 3035, (Bus) 663 0193.

Club name:	ST. GEORGE AMATEUR RADIO SOCIETY.
Club call sign:	VK2LE.
Meeting place:	Civil Defence Headquarters, Highgate Street, Bexley.
Day and time:	First Wednesday of each month 7.30pm.
Affiliation:	WIA NSW Division.
Net frequency:	Channel 4 repeater VK2RLE, Thursday 8.00pm, 14.1MHz VK2LE, Thursday 7.30pm
Contact:	The Secretary, SCARS, PO Box 77, Penshurst 2222.

Club name:	HORNSBY & DISTRICT AMATEUR RADIO CLUB.
Club call sign:	VK2APF.
Meeting place:	Waitara Scout Hall, Palmeston Road, Hornsby.
Day and time:	Second and fourth Wednesday each month 8.00pm.'
Affiliation:	WIA NSW Division.
Net frequency:	146.55MHz FM; 3.56MHz, Mondays 8.00pm.
Contact:	Kurt Lass, VK2YCU, telephone 48 1426.

Club name:	BLUE MOUNTAINS RADIO CLUB.
Club call sign:	VK2AUX.
Meeting place:	Springwood Primary School and Blaxland Primary School.
Day and time:	Every Friday night 8.00pm at SPS and first Monday of each month 8.00pm at BPS.
Affiliation:	Blue Mountains Branch, WIA NSW Division.
Contact:	Peter Willis, telephone 39 2203 or Geoffrey Swift, telephone 39 1144.

Club name:	UNIVERSITY OF NSW AMATEUR RADIO CLUB.
Club call sign:	VK2BUV.
Meeting place:	Room 1 or 2, 2nd floor, Student's Union Stage 3 building.
Day and time:	First Thursday of each month at 1.00pm.
Affiliation:	WIA YRCS NSW.
Net frequency:	27.125MHz.
Contact:	The Union, Box 57, PO Box 1, Kensington 2033, or Sam Voron, VK2BVS, 2 Griffith Avenue, Roseville 2069, telephone 407 1066.

Club name:	NOVICE AMATEUR RADIO GROUP.
Club call sign:	VK2BNO.
Meeting place:	Wireless Institute Centre, 14 Atchison Street, Crows Nest.
Day and time:	Every Saturday afternoon 2.00pm-5.00pm.
Affiliation:	WIA Youth Radio Club Scheme.
Net frequency:	27.125MHz each Sunday at 11.00am and 7.30pm. WIA NSW Division News Broadcast.
Contact:	Brian Belcher, 73 Ernest Street, Crows Nest, telephone 43 5632.

AMATEUR BANDS

Club name: THE SYDNEY DX GROUP.
Club call sign: VK2BDX.
Meeting place: Wireless Institute Centre, 14 Atchison Street, Crows Nest.
Day and time: First Friday each month at 7.30pm.
Affiliation: WIA Youth Radio Club Scheme.
Net frequency: 27.125MHz 8.15pm each Sunday then QSY to 27.085MHz.
Contact: Roger Brown, VK2BEQ, 18 Bradleys Head Road, Mosman 2088, telephone 969 2487.

Club name: WESTLAKES RADIO CLUB.
Club call sign: VK2ATZ.
Meeting place: Club Rooms, York Street, Teralba.
Day and time: Each Saturday afternoon and Wednesday evening.
Affiliation: WIA and YRCS NSW Division.
Net frequency: Not stated.
Contact: Eric Brockbank, VK2ZOP, Secretary, PO Box 1, Teralba, NSW 2284. Club telephone 58 1588.

Club name: SYDNEY UNIVERSITY AMATEUR RADIO CLUB.
Club call sign: VK2BSU.
Meeting place: Check WIA broadcasts or Uni "Daily Bull".
Contact: Jeff Pages, VK2BYY, telephone 649 9829 or write to Box 398, Wentworth Building, Sydney University 2006.

Club name: CAMPTEC (Camp Technology).
Club call sign: VK2BCT.
Meeting place: "The Grange", Mt. Victoria, NSW.
Day and time: Three one week residential camps each January.
Affiliation: YRCS NSW.
Net frequency: 14MHz and 146MHz and operation on other bands.
Contact: Mr J. Wightman, 10/37 Eddystone Road, Bexley, NSW 2207.

Club name: WESTERN SUBURBS RADIO CLUB.
Club call sign: VK2BWS.
Meeting place: Scout Hall, Cnr. Fowler and Kenyons Roads, Merrylands, NSW.
Day and time: Second and fourth Tuesday of each month at 8.00pm.
Affiliation: WIA NSW Division.
Net frequency: Nil.
Contact: Peter Gosling, 14 Clarke Street, Berala, 2141.

Club name: MOORABBIN AND DISTRICT RADIO CLUB.
Club call sign: VK3APC.
Meeting place: Club Rooms, Turner Road, between Nepean Highway and Chesterville Road, Moorabbin.
Day and time: Third Friday of each month at 8.00pm.
Affiliation: WIA Victorian Division.
Net frequency: Nil.
Contact: Secretary Graham Mason, VK3YGM, 3 Mason Court, Highett 3190, telephone 95 8108.

Club name: EASTERN AND MOUNTAIN DISTRICT RADIO CLUB.
Club call sign: VK3ER and VK3BNW.
Meeting place: General meetings in the Willis Room of the library. Branch meetings in the Coffee Shop, Nunawading Civic Centre, Maroondah Highway, Nunawading.
Day and time: General meeting first Friday of each month and Branch meeting fourth Friday of each month commencing at 8.00pm.
Affiliation: WIA Victorian Division.
Net Frequency: 3660kHz each Monday at 8.00pm.
Contact: Secretary Bob Duckworth, VK3AIC PO Box 87, Mitcham, Vic. 3132, telephone 725 8656.

Club name: WESTERN SUBURBS RADIO CLUB (VICTORIA).
Club call sign: VK3AWS.
Meeting place: Recreation Room, Melbourne Caravan Park, 263 Elizabeth Street, East Coburg.
Day and time: First and Third Friday each month (except January) at 8.00pm.
Affiliation: Not stated.
Net frequency: Not stated.
Contact: Secretary Reg Loyd, VK3KK or publicity officer Robert Ayton, VK3WS.

Club name: GEELONG AMATEUR RADIO & TV CLUB.
Club call sign: VK3ATL.
Meeting place: Club Rooms, Storrer Street, East Geelong.
Day and time: Each Friday night at 8.00pm.
Affiliation: WIA Victorian Division.
Net frequency: Channel 8 repeater VK3RGL.
Contact: Secretary, PO Box 520, Geelong 3220, or Alan Bradley, VK3LW, telephone 43 7550.

Club name: GEELONG RADIO AND ELECTRONICS SOCIETY.
Club call sign: VK3ANR.
Meeting place: Club Rooms, Recreation Reserve, Breakwater Road, Belmont, Victoria.
Day and time: Not stated.
Affiliation: Not stated.
Net frequency: Not stated.
Contact: M. G. Hepner, Secretary, PO Box 962, Geelong, Victoria 3220.

Club name: WARRNAMBOOL AMATEUR RADIO CLUB.
Club call sign: VK3ASZ.
Meeting place: Buffalo Lodge Rooms, Kariot Street, Warrnambool.
Day and time: First and third Wednesday of each month at 8.00pm.
Affiliation: WIA Victorian Division South West Zone.
Net frequency: Not stated.
Contact: Ian Mason, PO Box 10, Yambuk, Vic. 3285, Publicity Officer.

Club name: LARA – LADIES' AMATEUR RADIO ASSOCIATION.
Club call sign: Nil.
Meeting place: As arranged each month in Melbourne. Other locations to be organised.
Day and time: As suitable to members.
Affiliation: WIA State Divisions.
Net frequency: 3650kHz each Monday evening at 8.00pm.
Contact: LARA (Australia), C/-412 Brunswick Street, Fitzroy, Vic. 3056.

Club name: GOLD COAST RADIO CLUB.
Club call sign: VK4WIG.
Meeting place: Surfers Paradise old state school.
Day and time: First Friday of each month at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 2 repeater VK4RGC, Sunday evening 7.30pm and 3565kHz or 3650kHz Sunday evening at 8.00pm.
Contact: Secretary, PO Box 588, Southport, Qld. 4215.

Club name: CENTRAL QUEENSLAND BRANCH – WIA QLD, DIVISION.
Club call sign: VK4WIR.
Meeting place: Adult Education Rooms, Technical College, Rockhampton.
Day and time: Third Friday of each month at 7.45pm.
Affiliation: WIA Queensland Division.
Net frequency: FM Channel 50, repeater VK4RAR channel 4.
Contact: Secretary, PO Box 496, Rockhampton, Qld. 4700, Doug Kraatz, VK4ZDK, telephone 28 2533.

Club name: DARLING DOWNS RADIO CLUB.
Club call sign: VK4RDD repeater.
Meeting place: Toowoomba Education Centre, Baker Street, Darling Heights, Toowoomba.
Day and time: Last Friday of each month (except December) at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 4 repeater VK4RDD.
Contact: Secretary, 241A McKenzie Street, Toowoomba, Qld 4350.

Club name: IPSWICH AND DISTRICT RADIO CLUB.
Club call sign: VK4WIP.
Meeting place. Club Rooms, Deebing Street, Denmark Hill, Ipswich.
Day and time: Every other Tuesday evening, at 7.30pm.
Affiliation: WIA Queensland Division.

Net frequency: Repeater VK4RAI channel 6.
Contact: Secretary, PO Box 250, Ipswich, Qld. 4305.

Club name: QUEENSLAND BRANCH HQ BOY SCOUTS RADIO CLUB.
Club call sign: VK4QH.
Meeting place: Baden Powell Park, Samford.
Day and time: First Sunday of each month at 9.30am to 1.00pm.
Affiliation: WIA Queensland Division.
Net frequency: 7070kHz 9.30am to 11.00am and 14.290MHz 11.00am to 1.00pm each Sunday.
Contact: Noel Lynch, VK4ZNI, 15 Noeline Street, Dorrington, Qld. 4060.

Club name: WINDSOR YMCA. RADIO CLUB.
Club call sign: VK4AYM.
Meeting place: Windsor YMCA, 387 Lutwyche Road, Windsor, Brisbane.
Day and time: Each Friday 7.00pm-9.00pm.
Affiliation: YMCA and WIA Queensland Division.
Net frequency: 3570kHz AM, 3530kHz CW, 27015kHz CW, 27125kHz SSB.
Contact: Roger Davis, telephone 356 9228 or Geoff Adcock, telephone 59 7332

Club name: THE BRISBANE VHF GROUP.
Club call sign: VK4IF.
Meeting place: Oakleigh Scout Den, High Street, Dorrington.
Day and time: Fourth Thursday of each month at 8.00pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 8 repeater VK4RBN.
Contact: A. Downie, VK4ZRF, 23 Vanburgh Street, Mt Gravatt, Qld. 4122.

Club name: BUNDABERG AMATEUR RADIO CLUB.
Club call sign: VK4BW.
Meeting place: Club Rooms, Avoca Street, West Bundaberg.
Day and time: First Wednesday of each month at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: Repeater in planning stage.
Contact: Secretary, PO Box 129, Bundaberg, Qld. 4670.

Club name: REDCLIFFE RADIO CLUB.
Club call sign: VK4RC.
Meeting place: Congressional Church Hall, Cnr. Ellan and Alfred Streets, Woody Point.
Day and time: Every Monday evening (except school holidays) at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: 3655kHz Sunday evening at 7.45pm and 14.3MHz Sunday evening at 8.00pm.
Contact: Secretary, PO Box 20, Woody Point, Qld. 4019.

Club name: MARYBOROUGH AMATEUR RADIO CLUB.
Club call sign: VK4WIB.
Meeting place: Old Boys School, Sussex Street, Maryborough.
Day and time: Every Monday evening at 7.45pm.
Affiliation: WIA Queensland Division.
Net frequency: FM channels 40 and 50.
Contact: Col Paton, 225 Pallas Street, Maryborough, Qld. 4650.

Club name: MACKAY AMATEUR RADIO CLUB.
Club call sign: Vk4WIM.
Meeting place: 13 Boundary Street, Mackay.
Day and time: Fourth Friday of each month at 8.00pm.
Affiliation: WIA Queensland Division.
Net frequency: FM channel 50 Thursday evening 8.00pm.
Contact: Secretary, PO Box 1065, Mackay, Qld. 4740.

Club name: TOWNSVILLE AMATEUR RADIO CLUB.
Club call sign: VK4WIT.
Meeting place: State Emergency Headquarters, Green Street, West End, Townsville.
Day and time: First Thursday each month 8.00pm.
Affiliation: WIA Queensland Division.
Net frequency: 53.032MHz Sunday 11.00am, 3605kHz Sunday evenings 7.45pm, Channel 2 repeater VK4RAT.
Contact: Secretary, PO Box 964, Townsville 4810.

Club name: CAIRNS AMATEUR RADIO CLUB.
Club call sign: VK4HM.
Meeting place: State Emergency Service Building, McNamara Street, Cairns.
Day and time: Second Wednesday of each month at 8.00pm
Affiliation: WIA Queensland Division.
Net frequency: FM channel 50 monitored.
Contact: Secretary, PO Box 1426, Cairns, QLD. 4870.

Club name: ELIZABETH AMATEUR RADIO CLUB.
Club call sign: VK5LZ.
Meeting place: Methodist Church Hall, Fairfield Road, Elizabeth Grove, Sth. Aust.
Day and time: First Saturday of each month at 8.00pm.
Affiliation: WIA South Australian Division.
Net frequency: Nil.
Contact: Secretary, PO Box 8, Elizabeth, SA 5112, or president Ted Cooling, telephone 255 2249; 255 7586 or publicity officer Bill Thomas, telephone 258 6070.

Club name: SOUTH COAST RADIO AMATEURS GROUP.
Club call sign: Not stated.
Meeting place: Baden Terrace, O'Sullivan Beach, Sth. Aust.
Day and time: Tuesday and Thursday nights, 7.00-9.30pm.
Affiliation: Not stated.
Net frequency: 3530kHz and 27.085MHz.
Contact: Nick Mclean, VK5NIC 33 Kentwood Rd, Morphett Vale Sth. Aust. Phone 382 5472.

Club name: WEST AUSTRALIAN VHF GROUP (INC.)
Club call sign: VK6WH & VK6VF/P.
Meeting place: Group Headquarters. Wireless Hill Museum, Cnr. Almondbury Road and McCallum Crescent, Ardross, WA.
Day and time: Fourth Monday of each month (December excluded) at 8.00pm.
Affiliation: WIA West Australian Division.
Net frequency: All two metre FM channels monitored.
Contact: T. C. Berg, VK6ZAF, 23 Beach Road, Bicton 6157, telephone 39 3614 (AH), 80 2749 (Bus). Postal: PO Box 189, Applecross, WA. 6153.

Club name: WAIT AMATEUR RADIO CLUB.
Club call sign: VK6PD.
Meeting place: Cultural Centre, West Aust. Inst. of Technology (WAIT).
Day and time: Wednesday 1.30pm – 5.00pm; 7.30pm – 10.30pm.
Affiliation: Not stated.
Net frequency: 14.170MHz daytime and evening, 3685kHz evenings.
Contact: Interclub Comm. Rep. Gill Weaver, VK6ZGI.

Club name: DARWIN AMATEUR RADIO CLUB.
Club call sign: VK8DA.
Meeting place: Northern Territory Emergency Services Building, Bishop Street, Winnellie.
Day and time: First Monday of each month at 8.00pm.
Affiliation: South Australian Division WIA.
Net frequency: Channel 50 (145.5MHz), 3555kHz.
Contact: Henry Andersson, VK8HA, PO Box 1418, Darwin. Telephone 81 8587.

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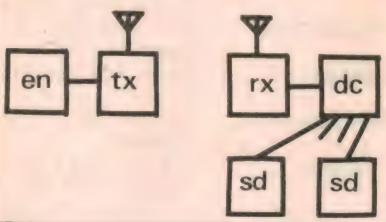
15 channel proportional encoder. This is a pulse width modulation type with synchronisation. It requires a 5 volt supply, and can directly drive a TXM module. All channel positions are set by 10k potentiometers, these are not supplied with the module or kit. This encoder can easily be converted to a system with fewer channels.

DECODER
DC15 Module...$13.50 Kit...$11.50

15 channel proportional decoder with synchronisation. It requires a 5 volt supply and is driven directly by the receiver module. Servo and drive unit will be featured in a later issue.



printed circuit boards

Boards required for building EA and ET projects will be available about one week from issue of the magazines. Also boards can be made to your artwork. In both cases the cost will be...

Single side laminate..	basic	80¢
	per square inch	5¢
Double side laminate..	basic	90¢
	per square inch	9¢
Single side fibreglass..	basic	80¢
	per square inch	9¢
Double side fibreglass..	basic	90¢
	per square inch	13¢

formers-ferrites

Ceramic Resonators		
SFD455B		$1.20
SFB455A		80¢
BFB455A		80¢
YFL455A		$2.50
Coils		
S201	90pF oscillator coil	$2.95
S203	200pF aerial coil	$2.95
ST45C	455kHz IF coil	$2.95
S195	Rf bandpass	$2.95
S196	Rf bandpass	$2.95
S500	Minature Osc, 3 x IF set	$2.50
Crystals		
2MHz	HiQ type.	$8.75
Slugs and Cores		
F16	4mm to 15MHz.	12¢
F29	4mm to 30OMHz.	12¢
500	6mm to 10MHz.	10¢
900	6mm to 60MHz.	10¢
901	6mm to 200MHz.	10¢
910	6mm to 300MHz.	10¢
Ferrite Cores		
FX1115	Ferite bead	15¢
P36	2242 replacement potcore	$2.75
P40	2243 replacement potcore	$4.50
E42	E core and former	$2.90
PL*	Large potcore for ETI427	$2.80
PS*	Small potcore for ETI427	$2.30
	* state uE values required.	
Coil formers		
722/1	5mm x 14mm former	10¢
722/4	5mm x 33mm former	12¢
5000A	7mm x 34mm former	27¢
5000B	7mm x 61mm former	27¢
6PLB	722 base	13¢
7100	722/1 can	16¢
7101	722/4 can	16¢
DTV2	5000A can	30¢
DTV1	5000B can	35¢

layout aids

PR12	50ml positive photo resist	$3.95
PD16	80gm positive developer	$1.75
DPB	Dalo resist pen	$2.38
FCA	500gm ferric chloride	$1.95
LF1	100ml liquid flux	$1.54
TO4	20 yd .04 black tape	$1.60
TO8	20 yd .08 black tape	$1.60
TO6	20 yd .06 black tape	$1.60
D100	88 .1 x .031 donut	$1.45
D156	88 .156 x .031 donut	$1.45
TO18	18 group of 3 leadouts	$1.45
TO5	18 group of 8 leadouts	$1.45
DIL14	16 groups of 14 pinouts	$1.45
DIL16	16 groups of 16 pinouts	$1.45
AFG	Sheet with .1 grid layout	65¢
XOB	pack of five exacto blades	$1.45
XOK	Exacto knife	$1.95

40411	RCA transistor	$2.50
TIP2955	Flat pack	$1.00
TIP3055	Flat pack	$1.00
FND500	.5" readout (cathode)	$1.95
FND507	.5" readout (anode)	$1.95
EM403	300V 1A diodes	6¢
22K	Double gang linear pots	69¢
47K	Double gang linear pots	69¢
100K	Double gang linear pots	69¢
47K	Double gang log pots	69¢
LM309K	TO3, 5 volt regulator	$1.25

specials

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7400	28¢	74121	50¢
7413	28¢	74151	$1.00
7440	28¢	741D (linear)	40¢
7442	60¢	SC141D	$1.20
7445	80¢	2500uF 25V	49¢
7446	80¢	8.2V zener	14¢
7448	80¢	12V zener	14¢
7460	35¢	24V zener	14¢
7479	40¢	27V zener	14¢
7483	95¢	30V zener	14¢
7492	70¢	BC350 pnp	9¢
7496	95¢	4016 CMOS	60¢

capacitors

Greencap... 100 volt	
.001, .0012, .0015, .0018, .0022,	9¢
.0027, .0033, .0039, .0047, .0056,	9¢
.0068, .0082, .01, .012, .015,	11¢
.018, .022, .027, .033, .039, .047	11¢
.056, .068, .082, .1, .12, .15,	16¢
.18, .22	16¢
Greencap... 250 volt	
.27, .33, .39, .47, .56,	36¢
.68, .82, 1.0,	55¢
1.2, 1.5, 1.8, 2.2,	$1.00
Greencap... 630 volt	
.001, .0015, .0022, .0033, .0039,	13¢
.0047, .0056, .0068, .0082, .01,	17¢
.015, .022, .033, .047, .1,	22¢
Ceramics... 630 volt	
10, 12, 15, 18, 22, 27, 33, 39,	7¢
47, 56, 68, 82, 100, 120, 150,	7¢
180, 220, 270, 330, 390, 470,	7¢
560, 680, 820, .001, .0012, .0015,	7¢
.0018, .0022, .0027, .0033, .0039,	7¢
.0047, .0056, .0068, .0082,	7¢

Electrolytics... PC board	25V	50V
2.2, 3.3, 4.7,	11¢	11¢
10, 22, 33,	13¢	15¢
47, 100,	18¢	22¢
220, 330, 470,	45¢	57¢
1000 uF	55¢	95¢
Electrolytics... Pigtail	25V	50V
2.2, 3.3, 4.7,	11¢	11¢
10, 22, 33,	13¢	15¢
47, 100,	18¢	22¢
220, 330, 470,	45¢	57¢
1000 uF	55¢	95¢

Tag Tantalums		
.1, .22, .33, .47, .68, 1.0,	35V	25¢
2.2, 3.3, 4.7, 6.8, 10,	25V	25¢
15, 22, 33,	10V	25¢
47, 68,	6V	25¢
100,	3V	25¢

showroom

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Shortwave Scene

by Arthur Cushen, MBE

Greenwich Mean Time is the term now used almost universally by short-wave stations. However, the term Co-ordinated Universal Time has now been adopted by scientists and astronomers, and some readers have suggested that this should also become the preferred term for international broadcasters.

A recent correspondent, Howard Barnes, of Auckland, New Zealand draws our attention to the use of Co-ordinated Universal Time in the scientific field and suggests it could be used in place of GMT. However, the fact that no directive from the ITU has been given to switch to the new time reference means that there is little hope of adopting the new symbol in the near future. As well, a change would cause confusion with short-wave listeners,

Mr Barnes points out that the Royal Greenwich Observatory (RGO) or as it was then, the Royal Observatory Greenwich, in 1675 adopted the local mean time, measured from noon on a 24 hour scale, as GMT. This worked fine until Britain adopted this meridian as its civil standard meridian in the 1800's – and then the world adopted it in 1884. For the present, it will be our policy to refer to time in Greenwich Mean Time as the magazine is read extensively not only in Australia but in many other countries. By using GMT it is simple for readers in any part of the world to convert GMT to their own time.

ENGLISH FROM STOCKHOLM

A new service in English for reception in Australia and New Zealand has recently been introduced by Radio Sweden with a transmission from 1100-1130 GMT. Two frequencies are used, 9630 and 15305kHz, and the service is daily except for certain Mondays when the transmitters are off the air for maintenance. The transmission, also beamed to Europe, could be received on both frequencies.

The test transmission in Swedish for this area continues on 9605kHz 0630-0800GMT for the period up to March 7 1977. Single sideband tests also continue: 0500-0800GMT 17775kHz; 0900-1300 17770; 1300-1400 17835; 1400-1600 17775; 1600-1800 15390; and 1800-2130 11770kHz. The transmitter is located at Horby, and the power is 30kW. A special verification card has been issued for these single sideband transmissions of the programs of Radio Sweden, Stockholm.

BROADCASTS FROM TIMOR

Now that some stability has returned to Timor, the radio scene is much clearer and broadcasts from both Kupang and Dili have been heard. Radio Republic Indonesia, Kupang, is broadcasting on 3550kHz up to 1520GMT. At 1400GMT a news bulletin in Indonesian was presented from the Kupang studios with several local identification announcements. Several Melbourne listeners report reception on 3550kHz and have also observed a relay on 3385kHz.

Radio Dili, which has been recently proclaimed the 49th RRI station of the Indonesian network, has been heard on 3120kHz at 1330GMT with a Portguese identification. The station closed at 1400GMT and used Via Condios as its closing melody. John Campbell reporting in "Down Under" DX news states that the station has also been heard on 3395kHz and a verification has been received. It came in the form of a postcard following a report to Dili.

VENEZUELAN SIGNALS

A new all night Venezuelan is Radio San Sebastian on 6070kHz, first reported by Jack Buckley of Sydney. Signals are only weak, and the station gives its slogan and frequencies about every 30 minutes. Furthermore, 6070kHz is blocked around 0750GMT by a strong Indonesian signal, so that reception is confined to about one hour of listening.

Another signal from Venezuela, that of Radio Nacional, is reported in DX post by Bill Vogel of Adelaide. The station broadcasts from Caracas on 15390kHz and was heard from 0140 to 0230GMT. Other reports indicate that the station has a broadcast in English 2200-2300GMT and that it is using 15490kHz, though it announces as using 6170 and 15390kHz.

VEITNAM RADIO

Ho Chi Minh City Radio stated that Liberation Radio had fulfilled its mission and had been closed down, according to the BBC Monitoring Service. With a view to better serving its listeners, the Voice of Vietnam is setting up a separate program network originating from the Central Radio broadcasting station in Ho Chi Minh City. The address of the station headquarters is No. 7 Xo Viet Nghe Link Street, Ho Chi Minh City.

Transmission time is from 2200-1605GMT and this period includes a considerable number of relays from the Voice of Vietnam, Hanoi, consisting of news, current affairs, people's Army broadcasts and ideological talks. Frequencies for this service are announced as 870, 6165 and 9620kHz. A continuous relay of the Voice of Vietnam, Hanoi, is given on 720kHz.

CANADA RETIMES SERVICE

After broadcasting to the South Pacific for nearly 30 years for our evening reception, Radio Canada in Montreal has made a major schedule change. The service to the South Pacific is now scheduled for our morning reception. The new transmission time is 2000-2030GMT in English and 2030-2100GMT in French. Three frequencies are being used: 15290, 15325 and 17820kHz.

In the past the transmission had been scheduled 0800-0900GMT and was a continuation of broadcasting after the service to Africa closed at 0800GMT. For a time, the broadcasts were 1000-1100GMT, which meant that the transmission was before the normal service to North America.

BROADCASTS OF BHUTAN

Broadcasts from the tiny state of Bhutan are now on a regular basis according to Adrian Peterson of Poona, India. He reported reception of a special test transmission on 7040kHz, commencing at 1230GMT and using the station's 300W transmitter at Thimpu, (the Bhutanese capital).

This is now a regular weekly transmission 1230-1330GMT and during the first progam consisted of English talks about the National Youth Association of Bhutan and about Bhutan in general. Selections of both European and Bhutanese music were also played during the one hour broadcast.

RADIO INCA LIMA

A newcomer to short-wave broadcasting is Radio Inca Lima in Peru, which is operating on 4762kHz and closes around 0600GMT. This station relays OBX4E on 1470kHz which has been operating in Lima for some years.

The shortwave outlet was first noticed in New Zealand by Dene Lynneberg of Wellington, and later reported by many other readers of the New Zealand DX Times. The station is announcing the short-wave frequency as 4762kHz, but has been measured on 4763kHz. The station has typical Spanish programs and has the address of The Director, Radio Inca del Peru, Avenue Nicolas de Pierola 533, Lima, Peru.

MEDIUM WAVE NEWS

AUSTRALIA: Charters Towers is to have a radio service with a repeater to be installed in the area to relay the program of 4AY Ayr Queensland. The power will be 100W, but the frequency has not been allocated. Programs will be fed from 4AY which at present operates 24 hours a day on 940kHz.

The West Australian Institute of Technology is now operating on 930kHz with 500W and has the call-sign 6NR. This is the second projected medium-wave station to be operated by a University, according Ian Stanley reporting in "Tune In".

Radio 5SE at Mount Gambier is now operating 24 hours a day on 1300kHz. According to Mark Shiell, Renown Park, SA, the station has moved into new studios at Commercial Street West, Mt. Gambier.

INDONESIA: The increasing number of medium-wave stations being put into operation in Indonesia has resulted in the country being well received on this band. Chris Martin of Sydney reports the reception of Jakarta on 999kHz at 1500GMT. Transmitter power is 300kW. Another new station opened recently and uses 100kW on 820kHz, and is located in Medan.

CANTON ISLAND: According to a letter received by Philip Brooks, Wanganui, NZ, station WXLE is to continue operation on a voluntary basis. Station WXLE was scheduled to close when forces pulled out of the island, but continued to operate 24 hours a day using tapes and live shows on 1385kHz. The staff find enjoyment in providing a radio service for the local population, and for ships and aircraft in the area.

AFRICA

GABON: According to Peter Bunn of Melbourne, reporting to "Australian DXers Calling", a verification from Radiodiffusion Television Gabonaise states that the Franceville facility operates on 3350kHz and 4830kHz using 4kW and 20kW respectively. Both channels are scheduled 0430-0630 and 1700-2200GMT.

GHANA: Radio Ghana was heard on 6130kHz at 2125GMT by Bill Vogel, reporting in "DX Post". The signal was heard to 2200GMT when interference was experienced from Deutsche Welle.

ASIA

NORTH KOREA: Radio Pyongyang has supplied their English schedule which gives their broadcasts as follows: 0600-0800GMT 9820 and 12075kHz; 1000-1100 7203 and 9768; 1200-1400 7580 and 9769; 2300-2400 11535 and 15630kHz.

NORTH YEMEN: Radio San'a has changed frequency from 7235 to 7265kHz according to the BBC Monitoring Service. The transmission schedule is 0300-0700 (1000 on Fridays), and 1100-2200GMT.

BRUNEI: Radio Brunei broadcasts in Malay on 4965kHz 2200-0600, 1100-1215, 1230-1430, and on Fridays and Sundays 2200-1430. English transmissions are from 2258-0030, 0300-0500 and 1200-1430 on 7215kHz, according to Bill Vogel of Adelaide.

PAKISTAN: Radio Pakistan has been heard on 15110 and 17665kHz at 1100GMT with slow speed news in English for Western Europe. The transmissions lasts for 15 minutes.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summertime, 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

INFORMATION CENTRE

CHRISTMAS TREE LIGHTS: With the approach of the festive season I wonder if you will give some thought to the problem of Christmas tree lights. The annual ritual of getting the conventional series wired systems into working order is expensive and time consuming. Lamps invariably fail and, last year, the problems were compounded by the complete unavailability of spare lamps.

I have thought of using low voltage LEDS powered by a transformer rectifier combination. I also envisage two, or more, strings of lamps of different colours operated from some form of sequential flasher. (M. K., Waramanga, NSW.)

• Many thanks for the suggestions, M. K., and we will certainly keep these in mind. Unfortunately there are problems, not at least of which is to provide a suitable transformer, with adequate insulation ratings, at a reasonable price. And, once such a transformer is provided, it may well be worthwhile retaining the original style lamps with their higher output. One suggestion was to drive three different coloured strings of lamps from a Musicolour, operating from appropriate musical numbers. While an intriguing idea, it would be easier to do with series strings at 240V than with low voltage parallel strings. Right now we are not sure how popular your idea would be with readers, particularly considering the low cost of typical lamp sets.

DX LISTENING: I read with interest your article on the LF and VLF Converter, described in March, 1976. I am interested in DX listening (and viewing) on TV, MW and LF bands and at one time I had a Marconi receiver from a submarine, and which tuned down to 10kHz. Many interesting signals were heard, even at these very low frequencies. However, the most interesting listening was on the LF broadcast band of 150kHz to 290kHz. I have received QSL cards from at least nine stations located in various parts of the USSR, using an aerial one hundred metres long. Reference to the World Radio & TV Handbook shows that there are now nine stations radiating from 500kW to 800kW and thirteen more on 1000kW to 2000kW on this band. I hope to obtain a new receiver with loop aerial and preamplifier in the near future and continue my DX activities on these bands. Also, over a six week period, I was able to log seventeen TV stations from three countries. The distances involved were from 1500kM to 4500kM. (B. C., Windsor, Qld.)

• Thank you for your letter and the interesting experiences you have had on the low frequencies and the TV bands. We agree that there are a lot of signals to be heard, particularly in the low frequency broadcast band, and it would seem that very few people have explored these regions. Although time is a limiting factor, we are also interested and we hope to do more along these lines in the future.

PROJECTOR: I have the opportunity to buy a Siemens 2000 projector. I wonder if any of your readers might be able to supply me with information on this projector. (P. Fuller, 24 Perman St, New Lambton, NSW, 2305.)

• We have printed your full name and address, Mr Fuller, so anyone who can help will be able to write directly to you.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

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COMMERCIAL SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia".

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

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SC/MP Editor . . . from p 93

Note that following the input of an A, R, or I command, the editor enters its text-input mode of operation. It will normally remain in this mode until it detects a "bell" character, whereupon it returns to the command mode, ringing the bell to indicate its response. If a tape being read in following the R command is terminated with a bell character (having been punched previously using the B command), this will take place automatically at the end of the tape.

All commands other than A, R or I cause the editor to return to command mode automatically when the command function has been performed.

Note that the editor will also return to the command mode automatically during text input (including during editing which involves additional text), if either of the internal line or text buffers become full.

The number of text lines held in the editor's buffer may be found at any time by typing an oblique (/) while in command mode. The editor will immediately type the current line total, in decimal.

When accepting text from the keyboard, the editor will detect a "percent" character (%) and interpret this as a destructive backspace. This may be used to correct character errors if they are noticed very shortly after entry (i.e., before the end of the line). Each percent character is interpreted as a one-character backspace, and the character may be used repeatedly to backspace right back to the start of the current line, if necessary.

Before punching a tape following the P or B commands, the editor pauses to allow the user to turn on the tape punch. Typing any character on the keyboard then causes it to punch a leader, the desired output text (followed by a bell character in the case of the B command), and finally a trailer. It then pauses once more, to allow the user to turn off the tape punch. After doing so, the user must then signal the editor to continue by typing any character via the keyboard.

The editor will automatically query any illegal commands, including commands which are not expressed in the correct form. It will also query you if the arguments in a command are either inappropriate to the command, or not valid for the text currently held in the buffer. For example if you have only 30 lines of text and you give it a command like 45L, it will promptly reply with a query.

The editor has been fairly extensively tested, and to the best of my knowledge it is now free of bugs. However, if you should find a bug, I would appreciate being advised so that all users can be informed.

Notes & Errata

ASCII-BAUDOT TRANSLATOR (October 1976, File No. 2/CC/15): Philips Industries Ltd has advised that the Signetics 2536 UART is no longer available. However they are able to supply the TMS 6011, which is an exact equivalent device.

RHYTHM UNIT (October-November 1976, File No. 1/EM/42, 43): We have been advised by C & K Electronics (Aust.) Pty Ltd that they are able to supply bexel-mounting paddle switches for the mute, reset and rhythm group select switches, having gold contacts to provide improved switching reliability and longer life. Designated type 7201-J61B, the switches are available with actuator paddles in a variety of colours if required. (C & K Electronics, Office 2, 6 MacFarlane St, Merrylands, NSW 2160.)

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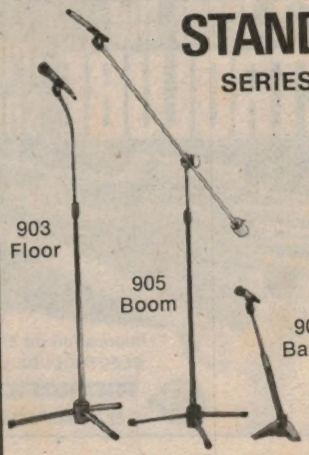

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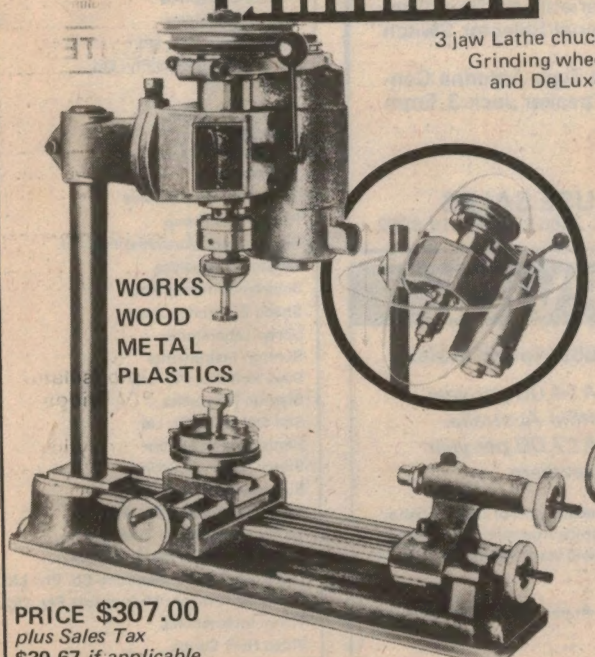

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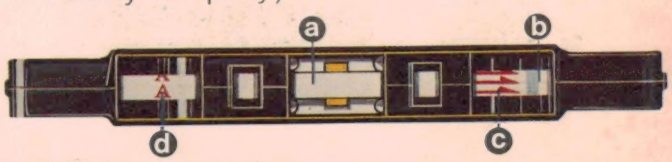
b) 5 second cueing line (recording function starts 5 seconds after the line appears).
c) Arrows indicating direction of tape travel.
d) A/B side mark (indicates which side is ready for play).



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